IN THE UNITED STATES DISTRICT COURT
FOR THE DISTRICT OF DELAWARE

APPLERA CORPORATION, MDS INC., and APPLIED BIOSYSTEMS/MDS SCIEX INSTRUMENTS, Plaintiffs, v. THERMO ELECTRON CORP., Defendant.	C.A. No.: 04-1230 GMS
THERMO FINNIGAN LLC, Plaintiff, v. APPLERA CORPORATION, MDS INC., and APPLIED BIOSYSTEMS/MDS SCIEX INSTRUMENTS, Defendants.	C.A. No.: 05-110 GMS

THERMO'S OPENING MARKMAN BRIEF

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INTRODUCTION

This brief addresses disputed claim language in two patents: U.S. Patent No. 4,963,736 (the "'736 patent"), asserted by Applera Corporation, MDS Inc., and Applied Biosystems/MDS Sciex Instruments (collectively "AB/Sciex") against Thermo Electron Corporation; and U.S. Patent No. 6,528,784 (the "'784 patent") asserted by Thermo Finnigan LLC (with Thermo Electron Corporation, collectively "Thermo") against AB/Sciex. Both patents concern the field of mass spectrometry.

I. Technological Background

A. Introduction to Mass Spectrometry and Mass Analyzers

Mass spectrometry is a technique to detect and analyze a substance present in a sample. For example, mass spectrometry can be used to determine whether an athlete's blood contains a specific steroid and, if so, how much. Mass spectrometry can also be used to help identify new treatments for disease by, for example, determining the presence and amount of proteins present in a blood sample, and thus determining how a new drug (such as the new cancer drug Taxol) works to treat disease.

Four general principles allow mass spectrometers to work:

(1) almost all atoms and molecules, the particles that form the basic building blocks of chemical substances, can be "ionized"—i.e., converted into ions, which are particles that have a net positive or negative electric charge;

(2) because ions have an electric charge, their movement can be controlled by electric and magnetic fields;

(3) each ion has a mass-to-charge ratio—i.e., a recognizable value for the ratio of the ion's mass to the ion's electric charge; and

(4) an ion's mass-to-charge ratio determines the ion's response to electric and magnetic fields.

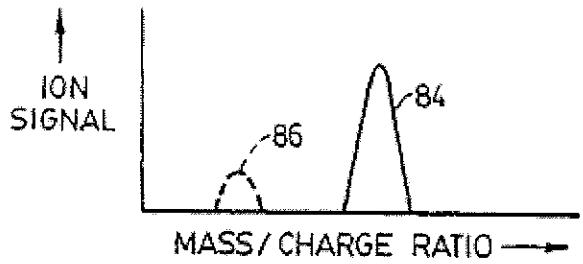
In accordance with these principles, a mass spectrometer generally operates to analyze material present in a sample by:

(1) ionizing a portion of a sample;

(2) using gas pressure and electric and/or magnetic fields to move ions of selected mass-to-charge ratios to a detector; and

(3) reporting the strength of the detector signal associated with the selected ions.

When mass spectrometers "scan" through a number of different mass-to-charge ratios present in a sample, the detector signal-strengths associated with the different mass-to-charge ratios are commonly reported in the form of a "mass spectrum"—i.e., a graph of signal strength as a function of mass-to-charge ratio. An example below is taken from Figure 14 of the '736 patent:



Consistent with the description above, a typical mass spectrometer can be understood as including five basic parts:

(1) an "ion source" chamber that takes in and ionizes sample material;

(2) a "mass analyzer" chamber that takes in ionized sample material and subjects it to electric and/or magnetic fields that, for example, filter, or trap and eject, ions selectively based on their mass-to-charge ratios;

(3) at least one, but sometimes multiple, intermediate chambers or devices that are placed between the ion source chamber and the mass analyzer chamber; for example, these chambers may include "ion guides" that "guide" ions into the analyzer, and "lenses" that "focus" the ions;

(4) a "detector" section that receives selected ions from the analyzer and produces electrical signals having intensities proportionate to the number of ions received; and

(5) a "data system" that reports information regarding the signals produced by the detector, often in the form of a mass spectrum.

The basic configuration (minus the "data system") of a typical mass spectrometer (of the "mass filter" type) is shown in Figure 1 of the '736 patent and in Figure 1 of the '784 patent.

Figure 1 of the '736 patent is reproduced below[1]:

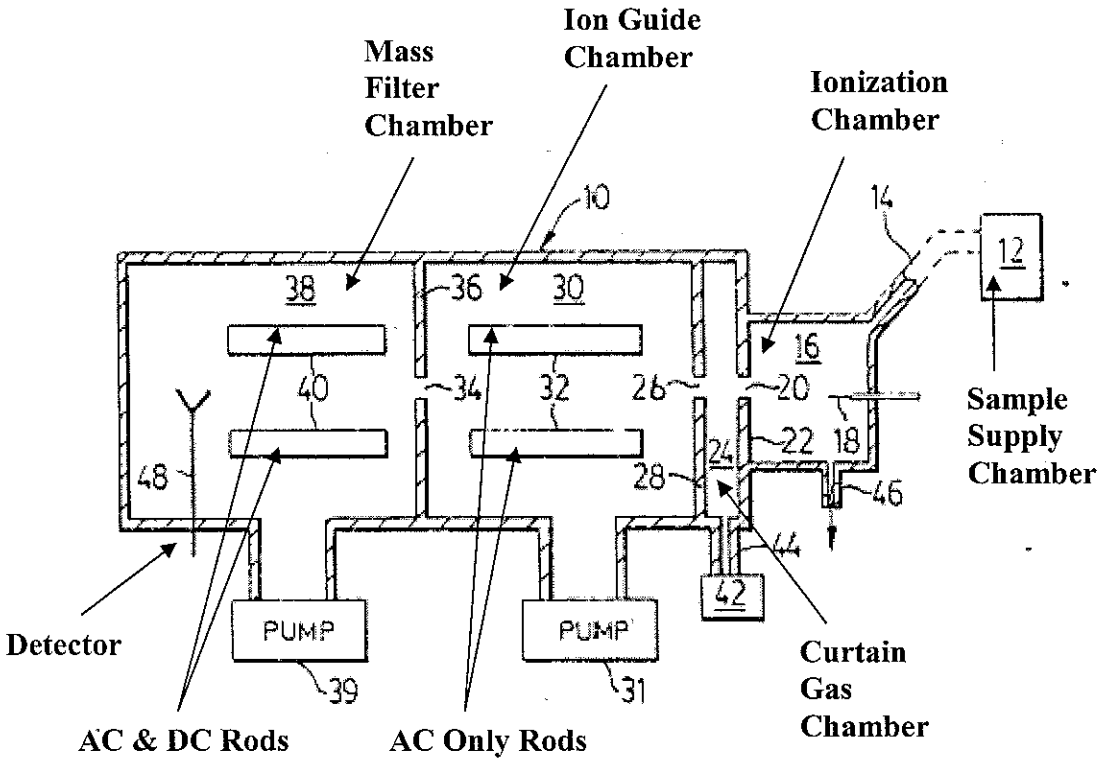
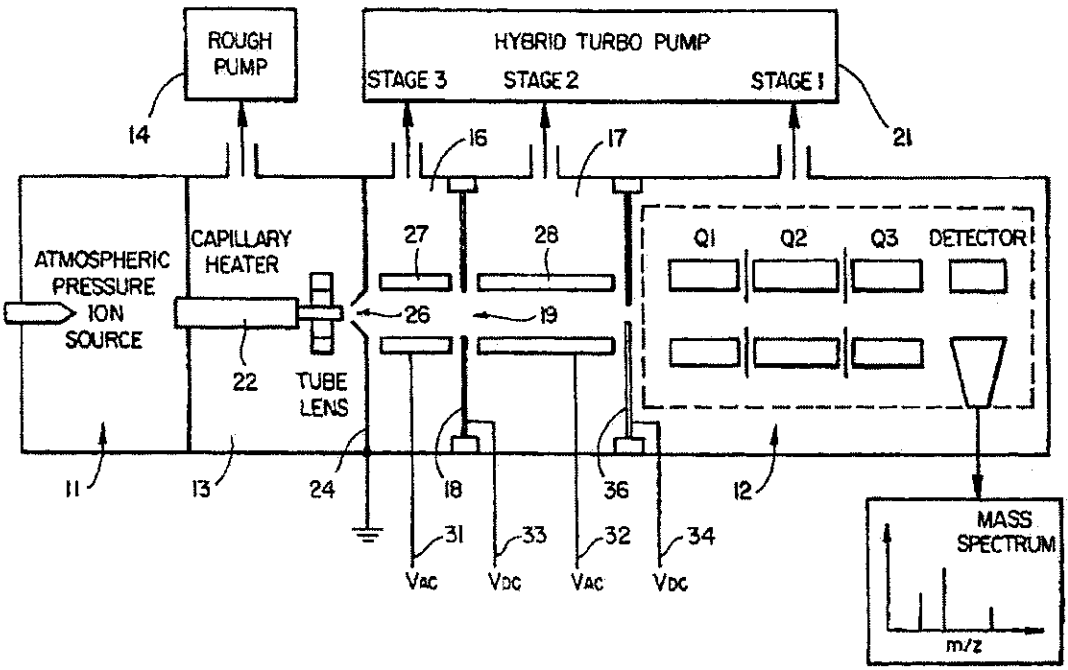


Figure 1 shows five chambers. The first chamber (12) is the sample supply chamber. The next chamber (element 16) is the ion source (ionization) chamber where the sample is ionized. The final chamber (element 38) is the mass analyzer chamber which selects the ions of interest for delivery to the detector. This final chamber also contains an ion detector (element 48), which detects the ions selected by the analyzer. Two intermediate chambers (elements 24 [a "curtain gas" chamber] and 30 [an "ion guide" chamber]) lie between the ion source chamber and the mass analyzer chamber. As discussed in detail below, the purpose of these intermediate chambers is (a) to move

[1] For ease of use, Thermo has annotated Figure 1 to indicate the location of the sample supply chamber, the ionization chamber, the curtain gas chamber, the ion guide chamber, the AC only rods, the mass filter chamber, the AC and DC rods, and the detector.

ions from the ion source chamber to the mass analyzer chamber, and/or (b) to step down the pressure from the high pressure ion source chamber to the low pressure mass analyzer chamber.

Figure 1 of the '784 patent is reproduced below:



In Figure 1 of the '784 patent, ions travel from left to right. The ion source chamber is element 11; the mass analyzer chamber is element 12. In between are three intermediate chambers 13, 16, and 17. Chamber 13 is usually called a "skimmer chamber"; the "skimmer" or "skimmer lens" is the aerodynamic cone-shaped element (24) that helps advance ion movement while deflecting neutral gas molecules. Chambers 16 and 17 are ion guide chambers.

B. The Use of DC Voltage and Pressure Differentials to Move Ions Through a Mass Spectrometer

Ions in the mass spectrometer must be moved from the ion source chamber "downstream" to the detector. There are two main methods to move the ions downstream: DC voltages and pressure differentials.[2]

1. DC Voltage

As is commonly known, the "north pole" of one magnet and the "south pole" of another magnet tend to attract each other when placed in close proximity (i.e., "opposites attract"). Similarly, two north poles of different magnets tend to repel each other when placed in close proximity. Similar rules (i.e., opposite charges attract, and like charges repel), apply to electrically charged particles, such as the ions in a mass spectrometer. In mass spectrometers, DC ("Direct Current") voltages are used to establish the desired attractive, or repulsive, forces that move ions along the instrument from the ion source chamber towards the detector.

As used here, a DC "offset" or "voltage difference" refers to the difference in DC voltages applied to two (or more) elements within the spectrometer. For example, if a voltage of –5 volts is placed on a lens and a voltage of –15 volts is placed on an ion guide, then the voltage "difference" or "offset" between the lens and the ion guide is 10

[2] As used in this brief, DC means "direct current," and AC means "alternating current." Thus, "DC voltage" refers to a voltage that does not change with time (i.e., is "static"), whereas an "AC voltage" does change with time. "RF" means "radio frequency," and refers to voltages that alternate with a certain speed ("frequency"). Terms like "difference" or "offset" refer to a difference in voltage that is applied to one element (e.g., a lens) as opposed to another element (e.g., an ion guide "rod"). The amount of the difference is expressed in units called "volts." Throughout the patents-in-suit (and indeed generally among engineers) terms such as "voltage" and "potential" are used somewhat loosely. It is thus common to see "voltage," "potential," "difference," and/or "offset" combined together (e.g., "voltage offset") and used interchangeably.

volts. (*See generally* JA 602, '784 patent, 3:27-31.[3]) In response to voltage differences created between and among the system elements, ions move along the length of a mass spectrometer much as water flows downhill.

Figure 1 of the '784 patent (illustrated above) presents one embodiment of this concept. The '784 patent describes using a DC voltage difference (or "offset") between the lens (24) that precedes the first "ion guide" chamber (16) and the "rods" of the "ion guide" (27), and another DC voltage difference between the lens (18) that precedes the second ion guide chamber (17) and the rods of the second ion guide (28). (*See, e.g.*, JA 602, '784 patent, 3:27-31 ("A DC voltage source is connected to provide a potential difference between the first lens and the first multipole ion guide or between the interchamber lens and the second multipole ion guide or both.").) This series of DC voltage "offsets" creates the electrical equivalent of a "downstream" force on the ions, so the ions are pushed from one element (lens 24) through and into a later element (rods 28).

2. Pressure Differential

Another way in which ions can be moved along the length of a mass spectrometer is to have successive chambers of the mass spectrometer be at successively lower pressures. Gas naturally flows from areas of high pressure to areas of low pressure. Thus, if the succeeding chambers in a mass spectrometer have ever-decreasing pressures, the ions will naturally travel away from the (high pressure) ion source and towards the (low pressure) analyzer. The result is a flow of both ions and uncharged particles from the higher pressure regions to the successive lower pressure regions.

[3] Citations to "JA" refer to the Joint Appendix, and citations to "TA" refer to the Thermo Appendix.

C. Use of "Ion Guides" to Help Move Ions from an Atmospheric-Pressure Source to a Mass Analyzer

Many ion source chambers operate in modern instruments at gas pressures that are at or near atmospheric pressure. In contrast, the pressure in the analyzer chamber is typically a "vacuum pressure" that is much less than one-thousandth of atmospheric pressure.

The difference in pressure between an atmospheric pressure source and a typical analyzer presents a challenge. How can a substantial number of ions be delivered from the atmospheric pressure ion source chamber to the analyzer chamber while keeping the analyzer at high vacuum? Or, in other words, how can enough gas be removed from the spectrometer so as to create the desired high vacuum in the analyzer chamber without also removing the ions that are to be analyzed?

A solution known by the mid-1980s was to include one or more intermediate chambers between the ion source chamber and the analyzer chamber, and to pump down the pressure in these intermediate chambers so that they were at pressures lying between the atmospheric pressure of the source chamber and the low pressure of the analyzer chamber. Each successive chamber was at a lower pressure than the chamber preceding it, and each successive chamber was separated from the chamber preceding it by a wall. A small hole in each wall allowed passage of ions from the preceding chamber into the successive chamber without a great loss of "vacuum." The successive chambers allowed for a gradual "step down" of the pressure. As noted above, Figure 1 of the '736 patent shows two intermediate chambers (24 and 30)—one of which (30) is a vacuum chamber—in between the source chamber (16) and the analyzer chamber (38); Figure 1

of the '784 patent shows three intermediate chambers (13, 16, and 17) all three of which are vacuum chambers.

Use of one or more intermediate chambers between the source and the analyzer made it easier to maintain the analyzer at low pressure while delivering to the analyzer ions from a relatively high pressure source. On the other hand, use of intermediate chambers introduced a new problem, namely how to ensure that ions intended for mass analysis successfully travel through the chamber. Ions can get "lost" (i.e., fail to travel through the chamber) in two ways.

First, ions can be sucked out of the chamber ("evacuated"), along with neutral gas molecules, by the vacuum pump. Second, ions generally lose their charge (and cease to be ions) if they collide with (touch) any of the surfaces of the spectrometer.

Therefore, ensuring that ions travel through the chamber, instead of getting "lost," requires applying forces to the ions that—without actually physically touching the ions—prevent the ions from being sucked out by the vacuum pump. An "ion guide" is a device that can provide the desired forces to ions, without touching them, so that the ions ultimately travel through the small hole at the opposite end of the ion guide chamber.

A typical prior-art ion guide was a "quadrupole" ion guide that included four cylindrical, parallel rods creating a pathway down which ions could be pushed, as illustrated below by Figure 3 from U.S. Patent No. 4,328,420. (The "pole" part of the terms "quadrupole" and "multipole" relates not to a "pole" in the sense of a "flagpole," but instead to "pole" in the sense of a pole of a magnet, or in the sense of either of the positive and negative electric terminals of a battery.)

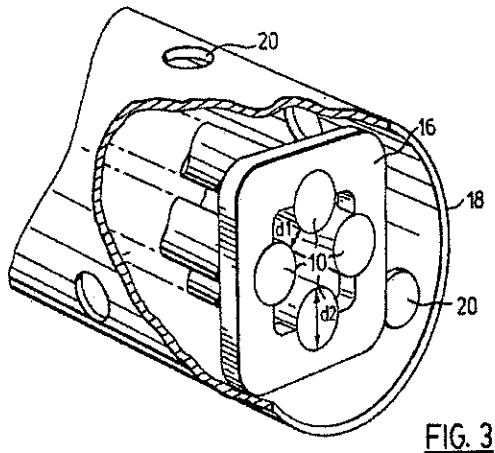
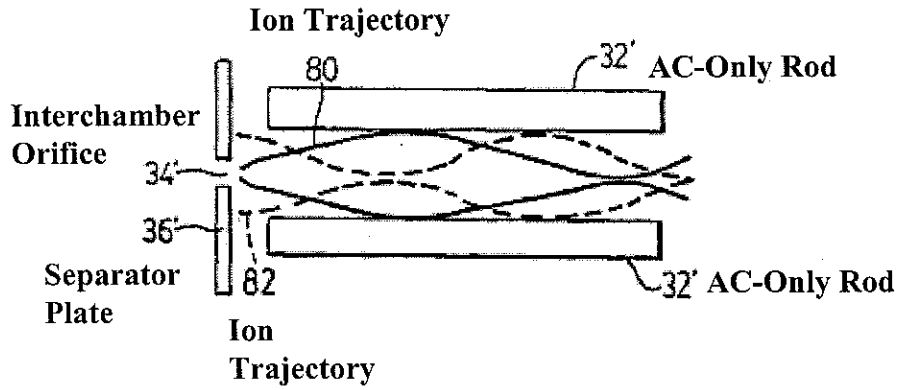


FIG. 3

(JA 108; *see also* JA 17, '736 patent, 4:51-53 ("The above structure and its operation as so far described are essentially the same as those described in said U.S. Pat. No. 4,328,420.").)

Figure 1 of the '736 patent shows one ion guide chamber (30); Figure 1 of the '784 patent shows two ion guide chambers (16 and 17).

Figure 13 of the '736 patent provides a good example of how ions are confined within a "rod set" of an ion guide while being pushed "downstream."



In Figure 13, the AC ("Alternating Current") voltages are applied between the rods; those voltages confine the ions in the space bounded by the top rod, the bottom rod, and the two side rods (recall that there are four rods although only two are shown in Figure 13, which is a two dimensional side-view).

Considering for simplicity a situation involving only two rods, application of AC voltages between the top and bottom rods means that the voltages on these rods oscillate between two states: (1) a state in which the top rod is at a voltage that is ***higher*** (more positive) than the voltage on the bottom rod; and (2) a state in which the top rod is at a voltage that is ***lower*** than the voltage on the bottom rod. When rods are in state (1), negatively charged ions are attracted by the top rod and repelled by the bottom rod. Conversely, when the rods are in state (2), negatively charged ions are repelled by the top rod and attracted by the bottom rod. Alternating back and forth between these states can cause ions to travel up and down between the rods without ever touching the rods.

In addition to an AC voltage applied to the rods themselves, a DC voltage applied between the front wall of the chamber and the rods can push the ions through the guide

(i.e., from right to left in Figure 13) while the AC voltages between the rods (discussed above) cause the ions to oscillate radially (i.e., up and down) between the rods. Likewise, a DC voltage applied between the "separator plate" 36' and the rods can "pull" ions out of the end of the guide.

D. Types of Mass Spectrometers

Mass spectrometers are typically classified in different categories based on the nature of their analyzers. There are many different types of "analyzers": mass filters, ion traps, ion cyclotron resonance analyzers, time-of-flight analyzers, etc. (*See*, *e.g.*, JA 604, '784 patent, col. 7, ll. 5-10.)

One popular form of mass filter is known as a "quadrupole mass filter."[4] Both a quadrupole mass filter and the quadrupole ion guide use AC voltages applied between the rods of a rod set to "confine" ions during their travel through the chamber (as is discussed above in the context of ion guides). A major difference between a "mass filter" and an "ion guide" is that, in addition to the AC voltages applied between the rods, mass filters also use a DC voltage between the rods (e.g., a DC voltage "offset" between the top rod and a side rod).

As ions travel down the length of a quadrupole mass filter, the DC voltage between the rods causes some of the ions to become unstable such that they are "lost," generally because they are pushed into contact with one of the rods.[5] Thus, whereas ion

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[4] Chamber 38 in Figure 1 of the '736 patent is described as containing "four standard quadrupole mass spectrometer rods 40" which "perform[] [their] normal function as a mass filter." (*See* JA 17, '736 patent, 4:27-28, 48.)

[5] Thus, three separate kinds of voltages are used in a quadrupole mass filter: (1) a DC voltage between a structure that precedes or follows the rods (e.g., a lens) and the rods themselves, which pushes or pulls ions through the rods (e.g., from right to left); (2) an AC voltage between the rods, which tends to confine ions within the space surrounded by the rods, such that the ions are not sucked out of the chamber by the vacuum pump

guides tend to cause all ions that enter the guide to travel through the guide (from one end to the other), mass filters create a "race course" that only some ions can successfully navigate. The factor that determines whether an ion will successfully navigate the course is its mass-to-charge ratio. For any given DC offset between the rods, ions of a selected mass-to-charge ratio will pass from one end of the mass filter to the other (and be sent to the detector), whereas ions with other mass-to-charge ratios will be pushed off course, or filtered out (such that they cannot reach the detector).

Ion traps are a different kind of analyzer used to deliver selected ions to a detector. Unlike mass filters, ion traps do not accomplish this key task by continuously transmitting selected ions to a detector while filtering out unwanted ions. Instead, as their name suggests, ion traps operate by receiving and then storing a batch of ions with a range of mass-to-charge ratios. When a particular type of ion is selected for detection, the voltages in the trap are manipulated to eject ions of the specific associated mass-to-charge ratio while containing all other ions within the trap. Thus, whereas mass filters operate by transmitting ions continuously, ion traps operate in a "batch mode," receiving and trapping a large collection of ions, selectively ejecting ions until analysis of that collection is complete, and then beginning a new cycle of reception, trapping, and selective ejection with a new batch of ions.

In earlier litigation against a different party (Micromass), AB/Sciex defined an ion trap in this same way, namely as "a device that consists of a chamber that is capable of

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along with neutrally charged gas molecules; and (3) a DC voltage between the rods, which causes the filter to act like a "race course" that allows only ions of selected mass-to-charge ratio to travel the full length of the rods.

storing ions for a relatively long period of time before ejecting the ions out of the device . . . ." (TA 235.)

Hence, if mass spectrometry's selection of particular ions is compared to processes for purifying water, a mass filter would be analogous to a water filter into which dirty water is continuously poured, whereas an ion trap would be analogous to a kettle that is first filled with a batch of dirty water and then is heated to extract purified water in the form of steam.

Another difference between mass filters and ion traps is that mass filters require a very high vacuum (extremely low pressure) to work their best. This is because the "resolution" of a mass filter—for example, its ability to select for detection ions of the specific mass-to-charge ratio 100 rather than ions of mass-to-charge ratio 101—depends on a careful tuning of the forces that act on ions. High pressure can interfere with this process because the selected ions collide with the gas in the chamber. Pumping the analyzer chamber to a very low pressure (i.e., removing most of the background gas) reduces the collisions. By analogy, consider attempting to knock a series of billiard balls, one after the other, into a pocket of a pool table when other balls stand in the way. If one pushes the balls directly toward the pocket, each will collide with the other balls, transfer energy to them, and likely be deflected from the desired course. Removing the "background" billiard balls makes the shots easier.

Ion traps, however, work differently, as was well known by the mid-1980s. Ion traps can in fact benefit from the presence of a certain amount of background gas. The background gas acts as a "damper" because collisions between ions and gas molecules help to remove energy from the ions (as in the billiard ball example). Thus, high

pressure—the presence of gas molecules—makes the ions easier to trap. Improved trapping generally translates into improved trap performance (better "sensitivity") because more of a sample will be retained for study, and therefore there will be more of any particular, potentially rare substance to detect.

II. The Patents in Suit and the Claims at Issue

A. AB/Sciex's '736 Patent

1. The Nature of AB/Sciex's Claimed Invention

The claims of AB/Sciex's '736 patent are directed to a "mass spectrometer system" and a "method of mass analysis" "of the kind in which" an ion guide helps to convey ions between an ion source and a "mass filter." (*See* JA 16, 22, 23, '736 patent, 1:7-12, 14:24-25, 14:49-57, 15:51, 16:3-10.) The ion guide and mass filter are in "first and second vacuum chambers separated by a wall," with the mass filter chamber being at a pressure that is "very low" or "substantially lower … than that of said first [i.e., the ion guide] chamber." (JA 22-23, '736 patent, 14:25-28, 14:31-35, 14:61-64, 15:51-57, 16:19-24.)

The claimed system is operated, and the claimed method is performed, in such a way as "to provide improved transmission of ions through [an] interchamber orifice" between the ion guide chamber and the mass filter chamber. (*See* JA 22-23, '736 patent, 14:25-28, 14:44-48; 15:5-7, 15:56-57; 16:27-29.) More specifically, the invention is described as producing "markedly increased" "ion transmission" under specific operating conditions. (JA 16, '736 patent, 1:29-34, 44-49.)

As the '736 patent itself states, the structural elements required by its claims were well known before the '736 patent—i.e., it is only the use of these known elements in conjunction with specific "operating conditions" that represents the alleged invention.

(*See* JA 17, '736 patent, 4:51-53 ("The above structure and its operation as so far described are essentially the same as those described in said U.S. Patent No. 4,328,420.").)

The named inventors of the '736 patent claim to have discovered that, under certain conditions, ion transmission could be improved by using relatively high pressure in the ion guide of a certain type of mass spectrometer. (*See, e.g.*, JA 16, 18, '736 patent, 1:42-49; 5:37-46.) The named inventors contend that before this (alleged) discovery, the conventional understanding had been that pressure in ion guides should be relatively low, because high pressure in the ion guide interfered with ion transmission. However, the named inventors then claimed that they "determined that under appropriate operating conditions, increasing the gas pressure . . . unexpectedly caused a considerable increase in the transmitted ion signal. (*See* JA 18, '736 patent, 5:41-46.)

According to the '736 patent, the alleged benefit of high pressure in the ion guide chamber is that there is more background gas. The ions collide with this background gas, and these collisions supposedly "focus" the ions into a tighter stream that is closer to the central axis of the ion guide. (*See, e.g.*, JA 18, '736 patent, 6:62-68.) According to the patent, focusing the ions into a tighter stream results in more of the ions passing through the ion guide and interchamber orifice, and into the mass filter. The patent refers to this phenomenon as "a kind of collisional focusing or damping effect." (*See* JA 18, '736 patent, 6:66-67.) Collisional damping was known in the art but not, according to the inventors, for use in an ion guide and mass filter under the specified conditions.

The patent claims a precise relationship to achieve the benefit of collisional damping in an ion guide, namely the relationship between the ***pressure*** in the ion guide

chamber and the ***length*** of rods in the ion guide chamber. That relationship is, according to the '736 patent, necessary to achieve the benefit of collisional damping and therefore enhanced ion transmission. Specifically, the pressure of the chamber times the length of the rods ("PxL") must be "equal to or greater than 2.25 x 10^{-2} torr cm."[6] (*See, e.g.*, JA 22-23, '736 patent, claims 1 and 14 (the two independent claims in the patent).)

According to the inventors, the prior art predominantly used "low pressure in the AC-only rod section." (JA 17, '736 patent, 4-5:66-16.) Hence, such art did not generally use PxL values at or above this magic PxL number of 2.25. To the extent that prior art did contain this PxL feature, AB/Sciex argued to the Patent Office (successfully) that such prior art was different from the invention because the prior art: (1) was not used in a "mass filter" system, and/or (2) was not used to improve ion transmission.

2. Prosecution History and Reexamination

The Patent and Trademark Office ("PTO") considered only two references during its initial examination of the application that led to the '736 patent—U.S. Patent No. 4,328,420, issued to French, and U.S. Patent No. 4,842,701, issued to Smith and others. (*See* JA 1, '736 patent, cover.)

In 1997, MDS Health Group Limited ("MDS"), the owner of the '736 patent, requested reexamination of the patent on the ground that prior art not considered during the original examination "may raise substantial new questions of patentability." (JA 171, Request for Reexamination.) MDS directed the PTO's attention to eight previously unconsidered prior art references. (JA 171-72, Request for Reexamination.) MDS characterized four of these references as being "directed to an ion trap" and/or "relat[ing]

[6] Torr is a measure of pressure. Atmospheric pressure is 760 Torr. The "cm" in the equation denotes centimeters and corresponds to the length of the rods.

to an ion trap." (JA 173-79, Request for Reexamination.) MDS characterized the other four references as directed to a "three-stage mass spectrometer"—i.e., a mass spectrometer having "three stages of quadrupoles aligned with each other." (JA 179-89, Request for Reexamination.)

In its Request for Reexamination, MDS distinguished the prior art ion trap references primarily by emphasizing that "[t]he ion trap, as described above, operates on a fundamentally different principle than the mass spectrometer according to the invention." (JA 176, Request for Reexamination; *see also* JA 173, Request for Reexamination; *cf.* JA 177-78, Request for Reexamination.) MDS's description of an ion trap—i.e., as a device "designed to trap or contain ions within a confined volume and then to apply specific fields to eject them"—made no distinction between sub-types of ion traps. (JA 174, Request for Reexamination.)

In the wake of MDS's distinction of ion traps as "operat[ing] on a fundamentally different principle than the [claimed] mass spectrometer," the ion trap references played no further role in the reexamination of the '736 patent. The PTO's grant of MDS's request for reexamination only referred to prior art that MDS had characterized as involving "a three-stage mass spectrometer." (*Compare* JA 378-79, Order Granting Reexamination, *with* JA 174, 180, 183, Request for Reexamination.) Based solely on this art, the examiner rejected all the original claims of the '736 patent as obvious over a combination of the French application and an article by Boitnott et al. of Finnigan Corporation (now plaintiff [in Civ. Action No. 05-110] Thermo Finnigan LLC). (JA 383, Office Action.)

After the named inventors further narrowed and clarified their invention, the PTO examiner declared the original claims of the '736 patent to be patentable, providing the following as "a statement of reasons":

[T]he French application does not operate with a product of pressure and rod length greater than or equal to 2.25 x 10^{-2} torr cm in a chamber containing a rod set operated with only AC voltages applied.

(JA 434-35, Office Action.) The examiner restated these "reasons for allowance" in the later Notice of Intent to Issue Reexamination Certificate. (JA 463, Notice.)

3. AB/Sciex's Suit Against Micromass for Infringement of the '736 Patent

Following reexamination of the '736 patent, AB/Sciex filed suit against Micromass UK Ltd. and Micromass Inc. in the District of Delaware, alleging infringement of the '736 patent. Thermo was not part of this case. The District Judge for the Micromass litigation, Judge McKelvie, construed various terms from the '736 patent's claims. Some of these terms are at issue in the present litigation between AB/Sciex and Thermo. On the other hand, several claim terms in dispute in the present litigation were not construed by Judge McKelvie. Among these are the terms "rod," "rod set," "rod means," claim 1's limitations requiring "means for applying" voltages, "mass filter," "very low pressure," and "a substantially lower pressure."

After claim construction, AB/Sciex went to trial against Micromass. AB/Sciex prevailed on certain issues, and lost on others, but obtained a jury verdict against Micromass. The Court generally declined to overturn the jury verdict, which was summarily affirmed by the Federal Circuit. *See Applera Corp. v. Micromass UK, Ltd.*, 186 F. Supp. 2d 487 (D. Del. 2002)(JA485); *Applera Corp. v. Micromass UK, Ltd.*, 204

F. Supp. 2d 724 (D. Del. 2002)(JA 529), *aff'd*, 2003 WL 1795593 (Fed. Cir. 2003) (JA590).

As will be discussed below, Thermo respectfully submits that certain of the claim constructions in the Micromass case were incorrect, in many cases because basic technical concepts were not explained to the Court by the parties. Most of these constructions Thermo believes to be incorrect do not appear to have been critical to the Micromass case and were not the subjects of appeal. For other claim constructions, the Federal Circuit's recent decisions in *Phillips v. AWH Corp.*, 415 F.3d 1303 (Fed Cir. 2005) (en banc), and other developments in the law since the Court's claim construction rulings in the Micromass case, affect the correctness of the Court's analysis.

B. Thermo's '784 Patent

1. The Nature of Thermo's Claimed Invention

The '784 patent describes an approach to using ***two*** ion guides in a mass spectrometer to "decluster" "adduct" ions, and thereby increase the flow of "sample" ions from "an atmospheric pressure ionization source" into a mass analyzer. (*See* JA 602, '784 patent, 3:45-58.) These sample ions are what a mass spectrometer is used to study. However, when atmospheric pressure sources are used, the sample ions often combine with particles of a background solvent material. (*See* JA 601, '784 patent, 2:33-39.) Combination of the sample ions and the solvent material forms "adduct ions." Adduct ions do not have the same mass-to-charge ratio as the original "sample ions." Consequently, the formation of "adduct ions" reduces the number of ions that an analyzer can detect when it looks for ions having the mass-to-charge ratio of the original "sample ions." (*See* JA 601, '784 patent, 2:42-51.) The result is a device with decreased ability to detect very small concentrations of sample ions, and decreased ability to relate the

number of sample ions detected to the concentration of sample ions in the original sample. (*See* JA 601, '784 patent, 2:42-51.)

The '784 patent discloses a solution to the problem of adduct formation. Key to the invention is the use of two ion guides, instead of, for example, the one ion guide that is shown in Figure 1 of the '736 patent. (*See* JA 602, '784 patent, 3:45-50.) According to this solution, voltages are supplied to the ion guides and to lenses preceding one or more of the ion guides so that adduct ions that enter the second ion guide's chamber are "dissociated"—i.e., broken up—into sample ions and solvent material. (*See* JA 602, '784 patent, 3:45-57.) The dissociation "breaks off" the solvent material without breaking up the sample itself, hence increasing the amount of sample ions that reach the detector.

In keeping with this invention, the asserted claims of the '784 patent (claims 1 and 4) claim: (1) two ion guides; and (2) a method of "increasing the kinetic energy of the adduct ions" so that the adduct ions break apart in the second ion guide. (*See* JA 604, '784 patent, claims 1 and 4.) In this context, "increasing the kinetic energy" simply means making the ions move "downstream" through the chambers. This downstream movement is accomplished by applying DC voltages on various elements (e.g., the rods in the ion guide and the lens plates preceding the ion guides) to move the ions. As a result of this movement, adduct ions break up due to collisions with background gas in the chamber, but ions of interest— "sample" ions—do not.

2. Prosecution History for the '784 Patent

The '784 patent issued from a continuation-in-part application filed on November 16, 2000. This application was preceded by a prior application filed on December 3, 1999. Certain claims of the initial application were rejected as anticipated or obvious over U.S. Patent No. 5,652,427, Craig Whitehouse et al. ("the Whitehouse patent"),

which disclosed use of multiple ion guides before a mass analyzer, but which did not disclose use of those ion guides to dissociate adduct ions. (*See* TA 40-41, Office Action; *see also* JA 706, 717, Whitehouse patent, 21:41-57 & fig. 14.)

The continuation-in-part application provided a new set of claims. Like the claim 1 that ultimately issued, the new claim 1 of the continuation-in-part application used "means … for increasing" language to describe the mechanisms for using the recited chambers and ion guides to bring about adduct ion dissociation. (JA 621, Application.) New claim 4 described a lens preceding the first ion guide in addition to a lens located between the ion guides, and recited "applying a DC offset voltage between a selected one or both ion lenses and the succeeding multipole ion guide." (JA 621-22, Application.)

The examiner initially rejected claims 1 and 4 of the continuation-in-part application as anticipated by the Whitehouse patent. (JA 855-56, Office Action.) A subsequent amendment added language to claims 1 and 4 clarifying the difference between "sample ions" and "adduct ions." (JA 928-29, Amendment/Response.) In claim 4, further language was also added to clarify that adduct dissociation did not involve fragmenting sample ions themselves. (JA 929, Amendment/Response.) The applicants pointed out that the Whitehouse patent provided "no teaching of disassociating adduct ions to form sample ions which together with those sample ions which are not adducted with solvent molecules increases the ion current." (JA 930, Amendment/Response.)

III. Basic Principles of Claim Construction

A. Legal Principles

As this Court is aware, the Federal Circuit recently reaffirmed the basic principles of claim construction in *Phillips v. AWH Corp.*, 415 F.3d 1303 (Fed. Cir. 2005) (*en banc*). Briefly stated, those principles are as follows: The words of a claim are to be

given the ordinary and customary meaning that a person of ordinary skill in the art would have understood the claim language to have in light of the patent documents at the time the patent application was filed. *See id.* at 1313. A court should derive this "ordinary and customary meaning" by looking to the claim language, the specification (which is "the single best guide to the meaning of a disputed term"), and the prosecution history. *See id.* at 1314-17. In conjunction with this intrinsic evidence, a court may also consider extrinsic evidence—such as dictionaries—although such evidence is generally "less significant" and "less reliable" than the intrinsic record in determining the meaning of claim language. *See id.* at 1317, 1318.

B. Means-Plus-Function Limitations

A "means-plus-function" claim limitation is one that is expressed as a means for performing a specified function without the recital in the claim of sufficient structure to perform the function. *See* 35 U.S.C. § 112, ¶ 6 (2000). Use of the word "means" invokes a presumption that a claim limitation is written in means-plus-function form and should be interpreted according to 35 U.S.C. § 112, ¶ 6. *See Sage Prods., Inc. v. Devon Indus., Inc.*, 126 F.3d 1420, 1427 (Fed. Cir. 1997). Under § 112, ¶ 6, a means-plus-function limitation "shall be construed to cover the corresponding structure . . . described in the specification and equivalents thereof." *See* 35 U.S.C. § 112, ¶ 6 (2000).

"The literal scope of a properly construed means-plus-function limitation does not extend to all means for performing a certain function. Rather, the scope of such claim language is sharply limited to the structure disclosed in the specification and its equivalents." *J&M Corp. v. Harley-Davidson, Inc.*, 269 F.3d 1360, 1367 (Fed. Cir. 2001).

Claim construction of a means-plus-function limitation is a two-step process. First, the court must identify the claimed function. *See Cardiac Pacemakers, Inc. v. St. Jude Med., Inc.*, 296 F.3d 1106, 1113 (Fed. Cir. 2002). Second, the court must "look to the specification and identify the corresponding structure to that function." *See Med. Instrumentation & Diagnostics Corp. v. Elekta AB*, 344 F.3d 1205, 1210 (Fed. Cir. 2003). In this second step, structure disclosed in the specification is "corresponding structure" only if the structure is capable of performing the recited function and the specification clearly links or associates that structure to the recited function. *See Cardiac Pacemakers*, 296 F.3d at 1113-1114.

If the specification fails to disclose corresponding structure for the recited function, the claim is invalid for failure to satisfy the definiteness requirement of 35 U.S.C. § 112, ¶ 2. *See id.* Material incorporated by reference cannot provide the corresponding structure necessary to satisfy the definiteness requirement for a means-plus-function clause. *See Default Proof Credit Card Sys., Inc. v. Home Depot U.S.A., Inc.*, 412 F.3d 1291, 1301 (Fed. Cir. 2005). Nor can the testimony of one of ordinary skill in the art supply the corresponding structure when the specification fails to disclose any structure for performing the recited function. *See id.* at 1302.

IV. Disputed Claim Terms for the '736 Patent

As AB/Sciex's proposed constructions are examined, a pattern emerges. With respect to its own '736 patent, AB/Sciex proposes constructions that are so broad or amorphous as to read entire limitations out of the claims. For example, AB/Sciex proposes to construe "rod" merely as "an electrode having a length . . .," which would cover every conceivable conductor of whatever shape, including many that are not rods. For means-plus-function claims, AB/Sciex seeks to include "acts" as structure that

corresponds to the claimed function, directly contrary to law. Yet when construing the terms of Thermo's patent, the '784 patent, AB/Sciex reverses its strategy. For Thermo's patent, AB/Sciex routinely seeks to import limitations from the specification and thereby to dramatically limit the scope of the '784 patent. Examples include AB/Sciex's attempt to limit "multipole ion guide" to a particular structure (a "rod set") with a particular voltage (AC); similarly, AB/Sciex attempts to import the term "immediately" to define the relationship between the lens and ion guide elements claimed in the patent. With respect to both patents, AB/Sciex's positions are contrary to the tenets of claim construction law, and to the plain and ordinary meaning of the claim terms at issue.

A. "Separated by"

'736 Term	Claims	Thermo Proposal	AB/Sciex Proposal
first and second vacuum chambers **separated by a wall** . . . an interchamber orifice located in said wall [claim 1] first and second spaces ... **separated by an interchamber orifice** [claim 14]	1, 14	1. "First and second vacuum chambers separated by a wall" means that a wall defines a common boundary of each of the first and second vacuum chambers. 1. "An interchamber orifice located in said wall" means an opening in the wall that connects the first and second vacuum chambers. 14. "First and second spaces . . . separated by an interchamber orifice" means an opening is located at a common boundary of each of the first and second spaces.	1. "Separated by a wall" means at least a wall between the first and second vacuum chambers. 1., 14. "Interchamber orifice" means an orifice in a wall between the first and second vacuum chambers.

Claims 1 and 14 of the '736 patent both claim "first and second vacuum chambers." (*See* JA 22-23, '736 patent, 14:25-26, 14:44-45, 15:52-53, 15:57.) Claim 1 then requires that the "first and second vacuum chambers" be "separated by a wall" in which an "interchamber orifice" is located. (*See* JA 22, '736 patent, 14:25-27, 45.) Claim 14 requires that "first and second spaces" within the respective "first and second vacuum chambers" be "separated by [an] interchamber orifice." (*See* JA 23, '736 patent, 15:56-57.)

The key dispute is the meaning of "separated by." Thermo's construction captures the plain meaning, namely that the wall (claim 1) and interchamber orifice (claim 14) form the dividing line between the first and second vacuum chambers or spaces. By contrast, AB/Sciex's proposed construction (adopted by Judge McKelvie) would merely require that the "separating" wall and "interchamber" orifice be located somewhere in between the first and second chambers or spaces. This is not what the claim says—Illinois does not "separate" New York and California.[7]

[7] In the earlier *Micromass* litigation, Micromass's analysis of "separated by a wall" was limited to a single paragraph of its Markman brief that did not meaningfully

Thermo's construction of the "separated by" limitations of claims 1 and 14 is consistent with both their plain meaning and their usage throughout the intrinsic record. The word "separate" means "[t]o set or keep apart," or to "divide." (TA 138, *American Heritage Dictionary of the English Language* (1982) (definition "**1a:**"); *accord* TA 180, *Webster's Third New International Dictionary* (1986) (definition "**1a:**"); TA 160, *Webster's Ninth New Collegiate Dictionary* (1988) (definition "**1a:**").)

A wall only "set[s] or keep[s] apart," or "divide[s]," a "first" and "second" chamber if the wall defines a common boundary between those chambers. In football, the 50-yard line separates one team's side of the field from the other team's side of the field. However, one would not describe the two teams' respective end zones as being "separated by" the 50-yard line. Likewise, one would only describe first and second spaces as "separated by an interchamber orifice" if the orifice defined a common boundary of the spaces—i.e., formed the dividing line between them.

The claims' requirement of an "***interchamber*** orifice" supports these conclusions. This orifice is defined to be "in said wall," and is the orifice interconnecting the first and second chambers. The prefix "inter-" means "between" and, in this context, "between" means "connecting." Hence, the claims' "interchamber orifice" is an orifice that itself connects the first and second vacuum chambers. (TA 174, *Webster's Third New International Dictionary* (1986) (defining "between" as meaning "shared by," "JOINING, CONNECTING <a passageway ~ two rooms>," or "filling the space limited by the two objects"); TA 153, *Webster's Ninth New Collegiate Dictionary* (1988)

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discuss or explain the issue. (TA 334, Micromass's Opening Claim Construction Brief.) Micromass did not even propose a specific construction for "separated by." Micromass devoted its energy to other claim terms, and hence it is not particularly surprising that the Court misconstrued this issue.

(defining "between" as meaning "from one to the other of" or "serving to connect or unite in a relationship"); TA 136, *American Heritage Dictionary of the English Language* (1982) (defining "between" as meaning "[c]onnecting spatially: *a path between the house and the road*").)

The '736 patent specification also supports Thermo's construction. Figure 1 of the '736 patent shows "a diagrammatic view of a mass analyzer system according to the invention." (*See* JA 17, '736 patent, 3:21-24.) In both this "view" and in Figure 12 (which is a "modification of . . . Fig. 1," *see* JA 17, '736 patent, 3:49-50), the "interchamber orifice" (**34** and **34'**, respectively) and the interchamber wall (**36** and **36'**, respectively) form the common boundaries between the first (ion guide) and second (mass filter) vacuum chambers. The same language as is used in the claim—"interchamber orifice"—is used to describe an opening that lies at the common boundary of the longitudinal spaces defined by the first and second rod sets. (*See* JA 17, '736 patent, 4:38-42.) Further, the role of the interchamber wall in defining a common boundary is emphasized by description in the specification of the wall as "the separator plate **36**." (*See* JA 17, 19, '736 patent, 4:24-26, 7:16-17, 7:23, 7:30, 7:42, 7:48-49.) The specification thus clarifies that "separated by" describes the common boundary between two chambers.

AB/Sciex relies for its erroneous construction of "separated by a wall" on the word "comprising" at the outset of claims 1 and 14, and on the word "a" in the phrase "separated by a wall." AB/Sciex says that because the claims use the word "comprising" and because claim 1 speaks of "a wall" and claim 14 speaks of "an interchamber orifice,"

it follows that "other structures may be present between the two vacuum chambers," or "separating [the first and second] spaces." *Micromass*, 186 F. Supp. 2d at 510.

This contention ignores the plain meaning of the words "separated by" and the placement of the term "comprising" in the claim. When a wall and "other structures" are between a "first chamber" and a "second chamber," the first chamber and second chamber are "separated by" a wall and the other structures, but not by a wall as the claim requires. Neither the wall nor the other structures "separates" or marks the dividing line between the first and second chambers in this example. Similarly there can be no "interchamber orifice" in "said wall" to connect the two chambers.

As regards the word "comprising," "comprising" is "not a weasel word with which to abrogate claim limitations." *Spectrum Int'l v. Sterilite Corp.*, 164 F.3d 1372, 1380 (Fed. Cir. 1998). The claim obviously permits the addition of structures beyond those specifically listed: for example, the spectrometer may "comprise" additional chambers, a housing, or an electronic clock not specifically defined in the claims. However, that principle does not permit the ***removal*** of a structure (a separating wall) that the claim specifically requires. *See id.* (noting that "comprising" cannot be invoked to "alter[] the scope of the particular claim" element at issue). Put another way, the claim language does not claim "comprising a wall," but rather "comprising . . . first and second vacuum chambers" that are expressly "separated by a wall." There may be ***more*** than first and second chambers in the system, but the first and second chambers must be "separated by a wall." AB/Sciex failed to appreciate this proper distinction concerning the term "comprising." *Cf. Free Motion Fitness, Inc. v. Cybex Int'l, Inc.*, 423 F.3d 1343,

1350 (Fed. Cir. 2005) (holding that phrase "comprising . . . a cable" is not limited to one cable).

Further, the requirement that the "first and second vacuum chambers" be "separated by a wall" would be superfluous if this language is construed as Judge McKelvie and AB/Sciex construe it. By definition, a "chamber" is an "enclosed space"—*i.e.*, a space with surrounding walls. (TA 154, *Webster's Ninth New Collegiate Dictionary* (1988) (defining "chamber" as meaning "a natural or artificial enclosed space or cavity"); TA 129, *American Heritage Dictionary* (2d coll. ed. 1985) (defining "chamber" as meaning "[a]n enclosed space or compartment: *the chamber of a pump; a compression chamber*").)

Thus, any two "chambers" by definition, have at least one wall between them. The claim limitation is only meaningful if, as plain language and the intrinsic record indicate, "separated by a wall" means that the separating wall defines a common boundary of the chambers. It is a basic rule of claim construction that all claim limitations are to be given meaning. *See, e.g., Tex. Instruments, Inc. v. U.S. Int'l Trade Comm'n*, 988 F.2d 1165, 1171 (Fed. Cir. 1993) (rejecting "contorted construction of the claim language" that "would render the disputed claim language mere surplusage" and "read an express limitation out of the claims"); *Merck & Co. v. Teva Pharms. USA, Inc.*, 395 F.3d 1364, 1372 (Fed. Cir. 2005) ("A claim construction that gives meaning to all the terms of the claim is preferred over one that does not do so.").

The Federal Circuit's *Phillips* decision supports Thermo's proposed construction. In *Phillips*, the specification disclosed a number of potential purposes for the "baffles" at issue. For example, the baffles could be used to provide support as well as to deflect

bullets. The *Phillips* court was particularly concerned that particular examples in the specification not be read into the patent claims as limitations, especially where the specification "sets forth multiple objectives to be served" by the claim limitation. *Phillips*, 415 F.3d at 1326-27. Similarly, the Court's main concern with dictionary definitions was that they not be cited to "extend" the meaning of words beyond "the avowed understanding of the patentee." *Id.* at 1321-22 (internal quotation marks omitted). Here, the '736 patent and its prosecution history reveal one and only one purpose for the claims' "separating" wall and orifice. The wall is "the separator plate" that divides the two chambers from one another. The interchamber orifice is in this wall. The specification and prosecution history provide no support for a system or method in which the interchamber "wall" or "interchamber orifice" are anything but this. *See, e.g.*, *LizardTech, Inc. v. Earth Resource Mapping, Inc.*, 424 F.3d 1336, 1344 (Fed. Cir. 2005) (In post-*Phillips* decision, Federal Circuit declined to read claim term "creating a seamless DWT" broadly, given that "there is no support for such a broad claim in the specification. The specification provides only a single way of creating a seamless DWT. . . .").

B. "Means for Generating Ions of a Trace Substance to Be Analyzed"

'736 Term	Claims	Thermo Proposal	AB/Sciex Proposal
means for generating ions of a trace substance to be analyzed	1	1c. The corresponding structure is an electric discharge needle, electrospray source, or other ionization source operating at approximately atmospheric pressure that is not after-developed technology. 2. "Trace substance" means matter that is present in a small amount or as a small fraction of a sample.	1c. The corresponding **structure, material, or acts** described in the specification is an electric discharge needle, electrospray source or other ionization source operating at approximately atmospheric pressure. 2. "trace substance": no construction needed.[8]

AB/Sciex and Thermo agree that the "means for generating" limitation is a means-plus-function limitation subject to § 112, ¶ 6. The parties also agree on the function associated with this means-plus-function limitation. The only differences in their proposed constructions are the following:

(1) AB/Sciex's proposed construction includes "corresponding structure, material, or acts" rather than the "corresponding structure" that is required for a structural means limitation subject to § 112, ¶ 6.

(2) Thermo's proposed construction includes explicit reference to the requirement, well established by case law, that the literal scope of a means-plus-function limitation not include "after-developed technology." *See, e.g., Al-Site Corp. v. VSI Int'l Inc.*, 174 F.3d 1308, 1320 (Fed. Cir. 1998) (An equivalent structure or act under § 112 cannot embrace technology developed after the issuance of the patent because the literal meaning of a claim is fixed upon its issuance.) Here the clarification is needed in the construction itself because the term "other ionization source" is itself so broad.

(3) Thermo proposes a construction of the technical term "trace substance" that is consistent both with dictionary definitions and the specification, whereas AB/Sciex asserts that this term does not need construction.

With respect to the first point of difference, Thermo seeks to ensure that the claim constructions adopted conform to existing law and do not misleadingly suggest that the

[8] "Trace substance" also appears in claim 14. The parties agree that whatever construction is adopted for "trace substance" for purposes of claim 1 should also apply for claim 14.

specification's disclosure of an "act" provides adequate support for a structural limitation subject to § 112, ¶ 6. As a matter of law, an "act" cannot be "structure" in a means-plus-function claim. *See O.I. Corp. v. Tekmar Co.*, 115 F.3d 1576, 1582-83 (Fed. Cir. 1997) ("The word 'means' clearly refers to the generic description of an apparatus element, and the implementation of such a concept is obviously by structure or material.... In [§ 112, ¶ 6], structure and material go with means, acts go with steps."); *cf. Default Proof*, 412 F.3d at 1300 (noting that "a human being cannot constitute a 'means,'" and therefore the specification must identify "***what structure the human being operates*** to perform the function" (emphasis added)). If an "act" could be sufficient to perform a "function" of a means-plus-function limitation, then no structure in the specification would ever be necessary to perform the function. The law, however, is exactly contrary.

With respect to construction of the term "trace substance," Thermo's proposed construction substantially tracks definitions in various general and technical dictionaries. (*E.g.*, TA 147, *McGraw-Hill Dictionary of Scientific and Technical Terms* (4th ed. 1989) (defining a "trace element" as "[a]n element found in small quantities (usually less than 1.0%) in a mineral"; and defining a "trace" as "[a]n extremely small but detectable quantity of a substance"); TA 183, *Webster's Third New International Dictionary* (1986) (defining a "trace" as "a very small quantity of a chemical constituent or component esp. when not quantitatively determined because of minuteness"); TA 133, *American Heritage Dictionary* (2d coll. ed. 1985) (defining a "trace" as "[a]n extremely small amount," or as "[a] constituent, as a chemical compound or element, present in quantities less than a standard limit").)

Thermo's proposed construction of "trace substance" is also consistent with the use of this technical term in the specification. (JA 16, 17, '736 patent, 1:15-18, 4:7-13.) Although AB/Sciex says that "trace substance" needs no construction, the term is not commonly known to laypersons; hence, construction by the Court will assist the jury.

C. "Means ... for Directing," "Means for Flowing," and "Means for Maintaining" Limitations

'736 Term	Claims	Thermo Proposal	AB/Sciex Proposal
means ... for directing said ions through said inlet orifice into said first vacuum chamber	1	The corresponding structures include "curtain gas plate **22**," "orifice plate **28**," and "rod set **32**."	The corresponding structure, material, or acts described in the specification is either, or both, of two independent operating parameters: (1) the application of appropriate DC potential between the inlet orifice and the rod set in the first vacuum chamber; and/or (2) a difference in the pressures on either side of the inlet orifice.
means for maintaining the kinetic energies of ions moving from said inlet orifice to said first rod set at a relatively low level	1	The corresponding structures include "curtain gas plate **22**," "orifice plate **28**," and "rod set **32**."	The corresponding structure, material, or acts described in the specification is the application of two variables: (1) a DC potential voltage between the inlet orifice and the first rod set, and (2) the pressure in the first vacuum chamber.
means for flowing gas through said inlet orifice into said first space	1	The corresponding structures include "curtain gas source **42**," "duct **44** to the curtain gas chamber **24**," "curtain gas chamber **24**," "orifice plate **28**," "orifice **26**," "vacuum pump **31**," and "vacuum chamber **30**."	The corresponding structure, material, or acts described in the specification is the existence of gas in a chamber, separated from the first vacuum chamber by the inlet orifice, at a higher pressure than that in the first vacuum chamber.

Claim 1 has a number of limitations reciting means for manipulating ions or gas into and through the ion guide chamber ("first vacuum chamber"). In particular, claim 1 requires:

- "means for ... directing said ions through said inlet orifice into said first vacuum chamber";
- "means for flowing gas through said inlet orifice into said first space"; and
- "means for maintaining the kinetic energies of ions moving from said inlet orifice to said first rod set at a relatively low level."

AB/Sciex and Thermo agree that all three of these limitations are means-plus-function limitations subject to § 112, ¶ 6. The parties also agree on the functions

associated with these limitations. The parties disagree as to the corresponding structures associated with the functions.

Following Judge McKelvie's constructions in the Micromass case, AB/Sciex argues that the "corresponding structure, material, or acts described in the specification" to these functions are "operating parameters," "the existence of gas in a chamber … at a higher pressure," and "the application" of voltage and pressure, respectively. That is not what the law allows, or what the specification says. These things are not structures at all, nor are they clearly linked by the specification to the claimed functions.

The "means for … directing" limitation and the "means for maintaining" limitation concern the means by which voltages are used to push ions into and through the ion guide chamber. Thermo's construction cites the actual structures in the specification which perform this pushing function: the corresponding structures are "curtain gas plate **22**," "orifice plate **28**," and "rod set **32**." These are the structures to which the DC voltages are applied so as to move the ions. Thermo's construction comes explicitly from the specification. In the quotation that follows, the "AC-only rod set 32" is the rod set in the ion guide, and the "rod set 40" is the rod set in the mass analyzer. Thus the passage describes how rods, AC voltages, and DC voltages are used to move the ions into and through the ion guide chamber:

> Ions produced in the ionization chamber 16 are drifted by appropriate DC potentials on plates 22, 28 and on the AC-only rod set 32 through opening 20 and orifice 26, and then are guided through the AC-only rod set 32 and interchamber orifice 34 into the rod set 40.

(JA 17, '736 patent, 4:38-42 (emphasis added).)

The "means for flowing" limitation concerns flowing gas into the first chamber (i.e., the ion guide chamber) for the ultimate purpose of creating a "downstream" pressure

differential. Again, the specification is explicit as to the corresponding structure: "curtain gas source **42**," "duct **44** to the curtain gas chamber **24**," "curtain gas chamber **24**," "orifice plate **28**," "orifice **26**," "vacuum pump **31**," and "vacuum chamber **30**." These are the structures that the specification clearly links to the recited function. In the quotation that follows the "first vacuum chamber 30" is the ion guide chamber:

> The curtain gas chamber **24** is connected by an orifice **26** in orifice plate **28** to a first vacuum chamber **30** pumped by a vacuum pump **31**. . . . An inert curtain gas, such as nitrogen, argon or carbon dioxide, is supplied via a curtain gas source **42** and duct **44** to the curtain gas chamber **24**. (Dry air can also be used in some cases.) The curtain gas flows through orifice **26** into the first vacuum chamber **30** . . . .

(JA 17, '736 patent, 4:19-21, 29-33 (emphasis added).)

AB/Sciex's proposed "structures" are incorrect because they are not "structures" at all. For example, an "application of appropriate DC potential" is not a structure—it is an injection of energy. *See O.I. Corp.*, 115 F.3d at 1582-83 ("The word 'means' clearly refers to the generic description of an apparatus element, and the implementation of such a concept is obviously by structure or material . . . ."). This Court should reject AB/Sciex's attempt to read statutorily required structural limitations out of the claims by transforming these means-plus-function limitations into purely functional limitations regarding how the overall device is run, rather than the particular structures of which it consists. *See, e.g., J&M Corp.*, 269 F.3d at 1367 ("the scope of such language is sharply limited to the structure disclosed in the specification and its equivalents"); *Biodex Corp. v. Loredan Med., Inc.*, 946 F.2d 850, 863 (Fed. Cir. 1991) ("[T]his Court has specifically cautioned against reading means-plus-function limitations to cover all possible means that perform the recited function.").

Judge McKelvie was never presented with these issues. In the case of "means for directing," the parties in the *Micromass* litigation had already agreed to the "structure," and the only issue presented to Judge McKelvie was whether this structure was "clearly linked" to the function, or else whether the claim was invalid for lack of corresponding structure. *See Micromass*, 186 F. Supp. 2d at 516-18 (JA 514-16). In the case of "means for maintaining," the issue was again whether there was "corresponding" structure at all. *Id.* at 526-27 (JA 524-25). For both terms, Judge McKelvie found that the claims were valid, and the issue was not appealed to the Federal Circuit. Here, Thermo agrees that the specification discloses corresponding structure—the dispute here is what that disclosed corresponding structure is. Judge McKelvie's analysis thus addresses a different issue and is not applicable to this case.[9]

In the case of "means for flowing," Micromass did contest this issue. However, nowhere did Micromass provide adequate explanation of the underlying technology. No one made clear, for example, the significance of the difference between (a) using the natural pressure differential between the atmospheric ion source and the low pressure analyzer to push ions "downstream," as opposed to (b) actually pumping gas into an intermediate chamber to create an additional pressure push. The '736 patent specification explicitly describes the latter "curtain gas" structure as part of the structure that makes "gas flow[] through orifice 26 into the first vacuum chamber . . ." (*See* JA 17, '736 patent, 4:26-34.) AB/Sciex's construction thus impermissibly broadens the claim term "means for flowing" by ignoring this clearly linked structure.

[9] Moreover, at least with respect to the "means for maintaining" limitation, Judge McKelvie agreed with AB/Sciex only on a contingent basis, "not mean[ing] to foreclose" an argument "that the voltage and pressure parameters are not a 'structure' for purposes of a means-plus-function limitation." *Micromass*, 186 F. Supp. 2d at 527 n.3 (JA 525).

D. "Rod," "Rod Set," "Rod Means," and "Parallel Rod Means"

'736 Term	Claims	Thermo Proposal	AB/Sciex Proposal
rod set	1, 14	a number of rods of the same kind that belong or are used together. This is in accordance with the meaning of "set," which means a number of things of the same kind that belong or are used together.	two or more rods.
rod	1, 14	a "slender bar" that is, in accordance with the meaning of "slender," narrow in circumference in proportion to its length, and substantially longer than it is wide.	"an electrode having a length along an ion path that produces an external electrical field over that length when a voltage is applied."
rod means	1	"rod means" is a means-plus-function limitation subject to 35 U.S.C. § 112, ¶ 6. The function is to define a elongated space therebetween. The corresponding structures are four 15-cm quadrupole mass spectrometer rods that are not too short as described in the specification.	"rod means" means "rods" and therefore requires no construction separate from the construction of "rods."
rod means	14	"rod means" is a means-plus-function limitation subject to 35 U.S.C. § 112, ¶ 6. The function is defining longitudinally extending first and second spaces, respectively. The corresponding structures are four 15-cm quadrupole mass spectrometer rods that are not too short as described in the specification.	"rod means" means "rods" and therefore requires no construction separate from the construction of "rods."
"parallel rod means"	1	**rod means** that extend in the same direction and everywhere equidistant.	**rods** that extend in the same direction and everywhere equidistant.

Thermo proposes that the term "rod" be construed to mean a "slender bar" in accordance with the term's ordinary meaning. (TA 159, *Webster's Ninth New Collegiate Dictionary* (1988).) Further, this construction is supported by the figures of the '736 patent, which show "rods" that are slender bars, substantially narrow relative to their length. (*See* JA 1, 10, '736 patent, figs. 1, 12-13.) The written description further describes AC-only "rods" that are "15 cm" (about six inches) in length and that "cannot

be too short." (*See* JA 18, 20, 22, '736 patent, 6:21-22, 9:13-14, 13:9-24.) The "15 cm" length figure was also cited by the patent holder in the '736 patent's reexamination history. (*See* JA 175, Request for Reexamination.) Hence, all of the intrinsic record's uses and illustrations of the term "rod" are consistent with its plain meaning, and there is no suggestion that the term "rod" should have any meaning other than the ordinary meaning that the specification and prosecution history support.

By contrast, AB/Sciex effectively attempts to read the term "rod" out of the claims. AB/Sciex's proposed construction ("an electrode having a length . . .") would mean that any conductor of whatever shape that has any "length along an ion path" could be a rod. According to AB/Sciex's proposed construction, even a perfect sphere or a cube could be a "rod." Because every shape has a "length," AB/Sciex's construction has no real meaning, and is tantamount to eliminating the "rod" limitation altogether. AB/Sciex's proposed construction thus turns a term describing a structure that has a particular shape (a slender bar) into a term describing a structure that could have any shape at all. *See Tex. Instruments*, 988 F.2d at 1171 (it is error to "read an express limitation out of the claims").

In addition, AB/Sciex's construction is contrary to AB/Sciex's own prior, judicially acknowledged concession in the *Micromass* case that "the electrode **rings** of [an] ion tunnel" differ from "**rod** sets" because the former "create electric fields in an axial dimension." 204 F. Supp. 2d at 774. AB/Sciex previously conceded (correctly) that a "ring" is not a "rod." Its present argument attempts to retract that concession to the Court.

AB/Sciex's construction of "rod set" similarly seeks to eliminate a limitation on claim scope. According to its plain meaning, the word "set" denotes "a number of things of the same kind that belong to or are used together." (TA 161, *Webster's Ninth New Collegiate Dictionary* (1988); *see also* TA 139, *American Heritage Dictionary of the English Language* (1982) ("**1.** A group of persons or things connected by or collected for their similar appearance, interest, importance, or the like …."); TA 181, *Webster's Third New International Dictionary* (1986) ("a group of articles of uniform design," or "an assortment of tools or instruments of identical kind").) This plain meaning is confirmed by both the specification and the prosecution history, which consistently describe "rod sets" as groups of like, if not identical, structures sharing a common function (such as "guid[ing] ions" or "mass analyzing") and forming—in all disclosed embodiments—a "quadrupole" of four symmetrically arranged parts. (*See* JA 1, 10, 16-18, 20-22, '736 patent, abstract, 1:8-13, 4:21-23, 4:27-28, 6:21-22, 9:29-32, 12:38, 13:9-12, figs. 1, 12-13; JA 102, Notice of Allowability.)

Now, AB/Sciex proposes that "rod set" only requires that there be "two or more rods," not that the "rods" be "of the same kind." This construction ignores the claim term "set."

AB/Sciex also seeks to eliminate the "rod means" limitation. The use of the term "means" triggers a presumption that the associated language is a means-plus-function limitation subject to § 112, ¶ 6. *See Sage Prods.*, 126 F.3d at 1427. ("The use of the word 'means,' which is part of the classic template for functional claim elements, gives rise to a presumption that the inventor used the term advisedly to invoke the statutory mandates for means-plus-function clauses.") (internal quotation marks omitted).

AB/Sciex now argues, however, that the word "means" has no significance and that the term "rod means" simply means "rods."

Thermo does not view the word "means" as superfluous. The "rod means" limitations of claims 1 and 14 are means-plus-function limitations. As indicated in claims 1 and 14, the associated function is "defin[ing]" one or more "elongated" (claim 1) or "longitudinally extending" (claim 14) spaces between the rods. The structures disclosed to perform this function are four 15-cm "quadrupole mass spectrometer rods" that are not "too short." (*See* JA 1, 10, 17-18, 20-22, '736 patent, abstract, 3:21-23, 3:49-53, 4:21-23, 4:27-28, 6:19-22, 9:13-14, 12:38, 13:9-20, 13:23-24, 14:4-10, fig. 1, 12-13.)

The single word "rod" in the claims does not connote sufficient structure to overcome the presumption. To the contrary, the '736 patent repeatedly emphasizes that only particular kinds of rods are contemplated by the invention.

In the specification, the inventors explained that a long pathway created by rods was necessary to create sufficient longitudinal space to ensure that enough collisions occurred to create the allegedly inventive "collisional focusing or dampening" effect:

> It is also noted that the number of collisions which an ion has while traveling through the AC-only rods 32 is determined by the length of the rods multiplied by the pressure between the rods. To a first approximation, it would be possible to double the pressure and then halve the length of the rods, and still have the same number of collisions. **However, the AC-only rod set 32 cannot be too short, since a sufficient number of RF cycles is needed for the AC-only rod set 32 to focus the ions** passing therethrough. Of course if the ions are slowed down by collisions during their passage through the rod set 32, then they will experience more RF cycles and will be better focused. . . . **In the equipment shown in Figs. 1 and [12] [a diagram view of the invention] the AC-only rods 32' were 15 cm long.**"

(JA 22, '736 patent, 13:3-15, 24-25 (emphases added).) Further, this long pathway must also be thin because ions need to be confined to a narrow beam so that they can be

transmitted effectively through "the small interchamber orifice 34." (JA 19, '736 patent, 7:35-36.)

> The patent specification continues:
>
> **In all cases** in which the relatively high pressures described are used, **the AC-only rods should occupy substantially all or at least a substantial portion of the length of [the] chamber**. . . . If they do not, scattering and losses will occur in the portion of these chambers in which the ions are not guided by the AC-only rods.

(JA 22, '736 patent, 14:4-10 (emphases added).)

E. "Extending Along at Least a Substantial Portion of the Length of Said Vacuum Chamber"

'736 Term	Claims	Thermo Proposal	AB/Sciex Proposal
extending along at least a substantial portion of the length of said first vacuum chamber	1	having a length extending at least most of the length of the first vacuum chamber.	"Substantial portion" means "a portion that is significant for purposes of avoiding scattering and losses of ions within the chamber."

Thermo's construction of this limitation relies upon the plain meaning of the term "substantial." (*See* TA 182, *Webster's Third New International Dictionary* (1986) ("considerable in amount, value, or worth"; "being that specified to a large degree or in the main"; and "of or relating to the main part of something"); TA 163, *Webster's Ninth New Collegiate Dictionary* ("significantly large," or "being largely but not wholly that which is specified").)

> The specification provides further guidance by teaching as follows:
>
> In all cases in which the relatively high pressures described are used, the [first rod set's] AC-only rods should occupy substantially all or at least a substantial portion of the length of chamber **30, 30'**. If they do not, scattering and losses will occur in the portion of these chambers in which the ions are guided by the AC-only rods.

(JA 22, '736 patent, 14:4-10 (emphasis added).) The specification also provides illustrations of the rods of the first rod set in which the rods "extend along" more than 60% of the length of the chamber. (*See* JA 1, 10, '736 patent, figs. 1, 12.)

AB/Sciex's proposed construction does not really construe the claim term. Instead, AB/Sciex attempts to turn a structural limitation regarding the rod set's length into a recitation of the rod set's "purposes."

F. "Elongated Parallel Rod Means Spaced Laterally Apart a Short Distance"

'736 Term	Claims	Thermo Proposal	AB/Sciex Proposal
each rod set comprising a plurality of **elongated** parallel rod means **spaced laterally apart a short distance** from each other to define an elongated space therebetween extending longitudinally through such rod set	1	1. "elongated" means "stretched out" and having a form notably long in comparison to its width." 2. "spaced laterally apart a short distance" means that the rod means are separated by a distance substantially less than the length of each elongated rod.	1. "elongated" means having a length that exceeds its width. 2. "spaced laterally apart a short distance" requires no construction.

1. "Elongated"

Thermo's proposed construction that "elongated" means "stretched out" and "having a form notably long in comparison to its width" is the plain meaning of the term. (TA 175, *Webster's Third New International Dictionary* (1986) (definitions of "elongated" and "elongate"); *see also* TA 155, *Webster's Ninth New Collegiate Dictionary* (1988) (defining "elongated" as meaning "stretched out" and "long in proportion to width").) The term "elongated" provides an extra limitation that the "rod means" in claim 1 be particularly long, i.e., "elongated." Thermo's construction captures that extra meaning.

AB/Sciex's construction suggests that "elongated" means little more than "non-square" or "non-circular." Under AB/Sciex's definition, any rectangle that has one dimension slightly longer than another is "elongated"—no matter how close that rectangle is to a perfect square. This is contrary to the plain meaning as well as the patent specification. As indicated above, the specification uniformly indicates that the "rod means" used are several times longer than they are wide, not merely slightly longer than wide. Rods are substantially larger than they are wide. "Elongated" "rod means," by definition, must be even longer. AB/Sciex's proposed construction would thus essentially (again) delete an express limitation.

2. "Spaced Laterally Apart a Short Distance"

Consistent with the ordinary meaning of the claims, the specification consistently shows and describes rod means that are "separated by a distance substantially less than the length of each elongated rod." (JA 1, 10, '736 patent, figs. 1, 12-13.) The spacing between the rods in that set is disclosed to be only "11 mm"—less than one tenth the length of the 15 cm rods. (*See* JA 18, 20, 22, '736 patent, 6:19-22, 9:13-14, 13:23-24.)

AB/Sciex asserts that the phrase "spaced laterally apart a short distance" does not need to be construed. Because "short" is an inherently relative term, however, the term should be construed. Specifically, the construction should recognize that "short" is meant to indicate a length substantially less than that of an "elongated rod."

G. "Space ... Extending Longitudinally" and "Longitudinally Extending Spaces"

'736 Term	Claims	Thermo Proposal	AB/Sciex Proposal
space . . . **extending longitudinally** through such rod set [claim 1] **longitudinally extending** first and second spaces [claim 14]	1, 14	space that runs lengthwise down the rods, **and that is longer than it is wide.**	space that runs lengthwise down the rods.

The terms "space ... extending longitudinally" and "longitudinally extending ... spaces" should be construed as describing the spaces that run lengthwise down the rods, and that are longer than they are wide. The last part of this construction—which AB/Sciex disputes—is meant to make clear that the terms "longitudinally extending" and "extending longitudinally" refer to more than the trivial fact that any space has *some length* in the longitudinal direction. For the terms "longitudinally extending" and "extending longitudinally" to be meaningful, they must refer to the lengthwise orientation and **extension** of the space—and not merely the trivial fact that the space has a length (which would make the claim limitation meaningless). This conclusion is consistent with the plain meanings of "extend" and "longitudinal," which mean, respectively, "to stretch out" and "of or relating to the lengthwise dimension," "placed or running lengthwise." (*See* TA 177, 179, *Webster's Third New International Dictionary* (1986).)

This conclusion is also consistent with the written description and figures. This intrinsic evidence uniformly describes the distance between the rods as substantially smaller than the length of the rods; therefore, this evidence uniformly shows first and second spaces that are "longitudinally extending"—i.e., running lengthwise down the rods, and longer than they are wide.

H. "Located End to End"

'736 Term	Claims	Thermo Proposal	AB/Sciex Proposal
located end to end	1, 14	No construction necessary in light of construction of "aligned."	the rod sets and spaces must be arranged in a manner that ions may be successfully transmitted from the end of the first rod set or the first space to the end of the second rod set of second space.

The construction of "located end to end" proposed by AB/Sciex is a residue from a construction adopted by Judge McKelvie to reject Micromass's argument that the rod set in one chamber must be placed against the rod set in the next chamber. *Micromass,* 186 F. Supp. 2d at 511-514 (JA 509-14). Thermo is not making this argument, so the proffered construction is not only long, but also confusing and unnecessary. Thermo submits that the phrase "located end to end" is something that the jury will understand without further explanation by reference, for example, to Figure 1 of the '736 patent.

I. "Means for Applying . . . Voltage"

'736 Term	Claims	Thermo Proposal	AB/Sciex Proposal
means for applying essentially an AC-only **voltage between the rod means** of said first rod set **means for applying** both AC and DC **voltages between the rod means** of said second rod set so that said second rod set may act as a mass filter	1	Although the specification discloses rods between which AC [and DC] voltages are applied, the specification does not disclose any structure for applying [both AC and DC voltages] between the rod means. Hence, the specification does not disclose the corresponding structure required for construction of this limitation under § 112, ¶ 6. This limitation and claim 1 are therefore indefinite.	The corresponding structure, material, or acts is described in the specification are the rods of rod set 32 [and 40] and, as is well known to those skilled in the art, an AC [and DC] power supply connected to the rods.

The parties agree that the "means for applying" limitations of claim 1 are means-plus-function limitations subject to § 112, ¶ 6. Further, except for AB/Sciex's effort to read its construction of "rod means" into the recitation of these different limitations' associated functions, the parties agree on the nature of those functions.

The disagreement between the parties is the question of what "corresponding structure … described in the specification"—if any—is clearly linked to perform these functions. *See* 35 U.S.C. § 112, ¶ 6; *Default Proof*, 412 F.3d at 1298 ("A structure disclosed in the specification qualifies as 'corresponding' structure only if the specification or prosecution history clearly links or associates that structure to the function recited in the claim.").

The specification does not disclose any structure for "applying essentially an AC-only voltage between the rod means of said first rod set," and likewise does not disclose any structure for "applying both AC and DC voltages between the rod means of said second rod set." Consequently, claim 1 is indefinite and invalid. *See Default Proof*, 412 F.3d at 1298-1303 (affirming ruling by district court that patent was indefinite and invalid because it failed to disclose corresponding structure).

AB/Sciex's proposed construction effectively concedes that there is no corresponding structure. AB/Sciex asserts that the corresponding structure for the "means for applying" limitations are "the rods" themselves and, "as is well known to those skilled in the art, AC and DC power supplies connected to the rods." AB/Sciex also cites another patent, U.S. Patent No. 4,328,420 ("the '420 patent"), in support of its assertion that the '736 patent discloses the required corresponding structure.

AB/Sciex's assertion that "the rods" are part of the "corresponding structure" for applying voltages to the rods makes no sense. "The rods" are not part of the "means for applying" voltages to the rods. The rods are the objects to which voltages are applied. The claim says means for "applying," not means for "receiving."

AB/Sciex's effort to find supporting structure in another patent and/or in the knowledge of those skilled in the art is legally unfounded. The recent *Default Proof* case issued holdings on both of these precise points. As a matter of law, corresponding structure cannot be found in either (a) material incorporated by reference into the patent at issue,[10] or (b) the knowledge of those skilled in the art. Instead, the supporting structure must be disclosed in the patent specification itself. *See Default Proof*, 412 F.3d at 1300-02 (stating that "material incorporated by reference cannot provide the corresponding structure necessary to satisfy the definiteness requirement for a means-plus-function clause"; also rejecting patentee's argument that structure "need not be expressly described in the specification, . . . as [it was] well known in the art.").

The law permits the drafting of a limitation in means-plus-function terms *only if*, in exchange, the patentee defines the scope of that limitation through a specification that describes "corresponding structure." *See Default Proof*, 412 F.3d at 1298 ("This duty to link or associate structure to function is the *quid pro quo* for the convenience of employing § 112 ¶ 6. Fulfillment of the § 112 ¶ 6 trade-off cannot be satisfied when there is a total omission of structure.") (citations and internal quotation marks omitted). In the case of the '736 patent's "means for applying" limitations, the patentees did not fulfill their end of this bargain. Consequently, the '736 patent's "means for applying" limitations cannot be construed, and claim 1 of the '736 patent is fatally indefinite. *See Default Proof*, 412 F.3d at 1302-03.

[10] The '736 patent cites but does not, in fact, incorporate the '420 patent by reference. (JA 16-17, '736 patent, 1:18-19, 4:6-7, 4:53.)

J. "Essentially an AC-Only Voltage"

'736 Term	Claims	Thermo Proposal	AB/Sciex Proposal
means for applying **essentially an AC-only voltage** between the rod means [claim 1] placing **an essentially AC-only RF voltage** between the rod means [claim 14]	1, 14	a voltage between the rod means that is essentially AC-only voltage and that lacks any placed DC component that would cause the rod set to act as a mass filter.	allows for some DC component.

"Essentially" means "by its very nature" and "fundamentally," and indicates that the property being described is "not accidental." (TA 176, *Webster's Third New International Dictionary* (1986) (definitions of "essentially" and "essential"); *see also* TA 137, *American Heritage Dictionary of the English Language* (1982) (defining "essential" as meaning "[o]f the fullest degree or extent; absolute; undiluted"); TA 425, *Webster's Ninth New Collegiate Dictionary* (1988) ("ESSENTIAL implies belonging to the very nature of a thing and therefore being incapable of removal without destroying the thing itself or its character.").)

Hence, "essentially an AC-only voltage" and "an essentially AC-only RF voltage" refer to a voltage that is by nature AC-only. It must lack any deliberately applied DC component that would cause the "rod set" in question to change its fundamental nature by being transformed from an ion guide into a "mass filter."

The specification compels Thermo's proposed construction by explicitly contrasting the placement of "a small DC voltage between the rods **32**" that would cause the rods to act as a mass filter with the use of "essentially an AC-only voltage." (*See* JA 21, '736 patent, 12:64 to 13:2.) In particular, the specification says:

> It is noted that although in this system described, the only voltage applied between the rods **32** is an AC voltage, it may be desired in some cases to place a small DC voltage between the rods **32**. In that case the rods **32** would act to some extent as a mass filter. However the voltage between rods **32** is preferably essentially an AC-only voltage.

(JA 21-22, '736 patent, 12:64 to 13:2.)

The prosecution history further confirms Thermo's proposed construction. During reexamination, AB/Sciex contrasted art that involved placing "AC and DC voltages" with the first rod set's "essentially an AC-only voltage." (*See* JA 180, 188, 193, 204.) Moreover, in both the original file history and the reexamination history, the examiner consistently referred to the invention as involving an "AC only" portion, thereby suggesting the understanding that there would be no DC component worth noting. (JA 102, Notice of Allowability; JA 434-35, Office Action in Reexamination; JA 463, Notice of Intent to Issue Reexamination Certificate.)

AB/Sciex proposes that "essentially AC only" means that the corresponding voltage can have "some DC component," ***without any limitation on its amount***. Without any restriction on the amount of the DC component, AB/Sciex's construction would mean that a voltage that was primarily and mostly DC, would at the same time be "essentially AC-only," even if the DC voltage were much greater than the AC voltage. Such a result would (again) read an express limitation out of the claim.

K. "Mass Filter"

'736 Term	Claims	Thermo Proposal	AB/Sciex Proposal
mass filter	1, 14	a device that passes through ions of one or more select mass-to-charge ratios while filtering out ions of all other mass-to-charge ratios, **and which does not function as an ion trap.**	a device that passes through ions of one or more mass to charge ratios while filtering out ions of all other mass to charge ratios.

The term "mass filter" appears multiple times in claims 1 and 14, in descriptions of the operation of the "second rod set." (*See* JA 22-23, '736 patent, 14:56-57, 14:63-64, 16:8-9, 16:22-24.) In the context of the '736 patent, the term "mass filter" must be construed to mean "a device that passes through ions of one or more select mass-to-charge ratios while filtering out ions of all other mass-to-charge ratios, ***and which does not function as an ion trap***." AB/Sciex agrees with the first part of this construction, but disagrees with the latter part of the construction making clear that an "ion trap" is not a "mass filter."

For multiple reasons, a "mass filter" cannot include an "ion trap," as a matter of law. First, Judge McKelvie ruled that the '736 claims do not cover ion traps, and AB/Sciex is bound by this ruling as a matter of collateral estoppel. Second, AB/Sciex itself represented to Judge McKelvie that ion traps were "not relevant" to the '736 mass filter claims in a (successful) effort to defeat Micromass's inequitable conduct charge. AB/Sciex is bound by these representations under the principle of judicial estoppel. Finally, AB/Sciex disavowed coverage of ion traps during patent prosecution, consistent with the plain meaning of "mass filter," which itself does not include an ion trap.

As discussed above in the Background section, the differences between "mass filters" and "ion traps" are substantial: "mass filters" are designed for continuous transmission of selected ions through the filter to a detector, whereas "ion traps" are

designed to store batches of ions for some period of time in a containment trap and then to eject selected ions from the trap. By claiming a "mass filter," the patent necessarily excludes devices that are ion traps.

The website for the American Society for Mass Spectrometry ("ASMS") confirms this plain and obvious distinction. A tutorial on the website (entitled "What is Mass Spectrometry?") notes, for example, that in a mass filter ions "pass through" the filter to reach the detector, whereas an ion trap is different because "it does not act as a filter." (*See* TA 339, American Society for Mass Spectrometry, *How Does the Analyzer Work?*)

In its 1997 Request for Reexamination, AB/Sciex confirmed that ion trap devices are outside the scope of the '736 patent's claims. In the Request, AB/Sciex addressed the argument that the '736 patent's use of relatively high pressures was obvious over ion trap art disclosing the same concept, namely that relatively high pressures could improve the performance of the trap by inducing collisional cooling and focusing. In other words, AB/Sciex felt a need to respond to the fact that use of high pressure by ion traps cast substantial doubt on the validity of the '736 patent.

AB/Sciex responded by characterizing mass-spectrometer systems using "ion traps" as non-analogous art that was irrelevant to the alleged invention. AB/Sciex successfully urged the Patent Office to disregard all ion trap references as possibly invalidating prior art. In particular, AB/Sciex characterized ion traps as "operat[ing] on a fundamentally different principle than the mass spectrometer according to the invention." (JA 176, Request for Reexamination; *see also* JA 173, Request for Reexamination ("Schaaf's ion trap operates on a fundamentally different principle than the claimed mass

spectrometer.").) Each of the prior-art trap references was distinguished from the claimed invention on the ground that it involved an ion trap. According to AB/Sciex:

- "Schaaf" is "directed to an **ion trap** rather than the claimed mass spectrometer system." (JA 175, Request for Reexamination (emphasis added).)
- "Vedel differs from the invention in that it relates to an **ion trap**." (JA 176, Request for Reexamination (emphasis added).)
- "Because Stafford is directed to an **ion trap**, Stafford does not disclose or suggest the first and second vacuum chambers, the first and second rod sets, the inlet orifice, the interchamber orifice, the application of AC-only voltage to the first rod set, and the application of AC and DC voltages to the second rod set." (JA 177, Request for Reexamination (emphasis added).)
- "The Stafford application is directed to an **ion trap** and therefore does not disclose or suggest the first and second vacuum chambers, the first and second rod sets, the inlet orifice, the interchamber orifice, the application of AC-only voltage to the first rod set, and the application of AC and DC voltages to the second rod set." (JA 178, Request for Reexamination (emphasis added).)

AB/Sciex's representation that ion trap mass spectrometers were non-analogous art was successful. Although the examiner initiated a reexamination based on certain references involving tandem mass spectrometers (JA 378, Request for Reexamination), the examiner never referred to any of the ion trap references during the reexamination.

The examiner accepted AB/Sciex's repeated and unequivocal statements and concluded that ion traps were categorically different from the "mass filter" claimed in the '736 patent.

During the Micromass litigation, the issue of ion traps arose again. AB/Sciex continued its unequivocal differentiation of ion trap mass spectrometers from the '736 patent's claimed "mass filter." In the Micromass litigation, the '736 patent's inventors were accused of inequitable conduct for failing to disclose ion trap prior art to the PTO. AB/Sciex responded by arguing repeatedly that it was under no duty to disclose the ion trap prior art because ion trap mass spectrometers were "not relevant" to the mass filter spectrometers covered by the '736 patent. In particular, AB/Sciex asserted:

> The inventors correctly believed that references relating to **"ion traps,"** a type of mass spectrometer, and "collision cells," a part of a "tandem" mass spectrometer, **were not relevant. An ion trap is a device that consists of a chamber that is capable of storing ions for a relatively long period of time before ejecting the ions out of the device**....
>
> Dr. Douglas testified that **an ion trap is "a very different device" because, *inter alia*, "there's no ion storage in the '736 patent**."

(TA 235, Pls.' Opening Br. in Support of Their Motion for Summary Judgment on Defendants' Inequitable Conduct Defense and Antitrust Counterclaims (emphases added); *accord* TA 306, Pls.' Answering Br. in Opposition to Defendants' Motion for Summary Judgment That the '736 Patent Is Unenforceable Due to Inequitable Conduct.)

As indicated in AB/Sciex's briefs in the Micromass litigation, one of the '736 patent's inventors, Dr. Donald Douglas, indeed had given deposition testimony about ion traps. More specifically, Dr. Douglas had made absolutely clear in sworn testimony that the '736 patent had nothing to do with ion traps, saying:

- "[T]here's ***no ion storage*** in the 736 patent."

- "There's nothing in the 736 patent about trapping."
- "I would say trapping ions, and not trapping ions is a ***big difference***."

(TA 336, Douglas Deposition, 397:14 to 398:19 (emphases added).)

Again, AB/Sciex's representations succeeded; it was found not guilty of inequitable conduct.

AB/Sciex and Dr. Douglas made general disclaimers of ion traps and ion trapping despite their thorough knowledge about the various kinds of ion traps (such as "three dimensional" and "linear" ion traps). On the same day that Dr. Douglas testified that "there's no ion storage in the '736 patent," he also said that he did "have a patent for trapping ions in a linear quadrupole," a device that uses "rods." (TA 337, Douglas Deposition, 420:13-14.) Dr. Douglas was then presented with U.S. Patent No. 5,179,278, which he "believed" to be the patent in question. (TA 337, Douglas Deposition, 420:19 to 421:10.)

Despite this knowledge of different kinds of ion traps, AB/Sciex made no distinction whatsoever about the ion traps it was disclaiming—ion traps were disavowed generally as "fundamentally different," "very different," and "not relevant."[11]

Relying upon AB/Sciex's repeated disclaimers, Judge McKelvie found that AB/Sciex had "disclaim[ed] coverage of ion traps," and ruled that Micromass "should be estopped from claiming that the claims of the '736 patent cover ion traps under the doctrine of equivalents." *Micromass*, 204 F. Supp. 2d at 773 (JA 578). Judge McKelvie explained:

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[11] In the present litigation, AB/Sciex has suggested that although it disclaimed ion traps, it only disclaimed a particular kind of ion trap (the "three dimensional" versus "linear" or "two dimensional" ion trap). This assertion has been fabricated for purposes of this lawsuit and has no basis in the historical record.

> The structural arguments made by AB/Sciex [during reexamination] were for the purpose of patentab[i]lity and **a competitor would reasonably conclude that ion traps would not infringe the claimed mass spectrometer system.**

204 F. Supp. 2d at 773-74 (emphasis added).

Because Judge McKelvie ruled (based upon AB/Sciex's own representations) that AB/Sciex "disclaim[ed] ion traps," AB/Sciex is now both collaterally and judicially estopped from arguing that the claims of the '736 patent are infringed by an ion trap mass spectrometer. *See Nat'l R.R. Passenger Corp. v. Penn. Pub. Utility Comm'n*, 288 F.3d 519, 525 (3d Cir. 2002) (setting forth the prerequisites for the application of issue preclusion); *Detz v. Greiner Indus., Inc.*, 346 F.3d 109, 115 (3d Cir. 2003) (discussing judicial estoppel). AB/Sciex is also estopped by its representations to the PTO during prosecution. *See Cultor Corp. v. A.E. Stanley Mfg. Co.*, 224 F.3d 1328, 1331 (Fed. Cir. 2000) (claims "are not correctly construed to cover what was expressly disclaimed"). The claims should be construed accordingly.

L. "Very Low Pressure" and "Substantially Lower Pressure"

'736 Term	Claims	Thermo Proposal	AB/Sciex Proposal
the pressure in said second chamber being a **very low pressure** for operation of said second rod set as a mass filter [claim 1] **a substantially lower pressure** than that of said first chamber, for effective mass filter operation of said second rod set [claim 14]	1, 14	The pressure in the second chamber is at least below 1×10^{-5} torr.	1. a pressure at which the second rod set will operate as a mass filter. 14. a pressure that is sufficiently lower than that of the first chamber such that the second rod set will operate as a mass filter.

Claims 1 and 14 of the '736 patent both contain limitations regarding the pressure in the "second chamber," i.e. the mass analyzer chamber. Claim 1 requires that this pressure be "very low," and claim 14 requires that the pressure be "substantially lower" than that in the "first chamber," i.e., the ion guide chamber. AB/Sciex concedes that these pressures in the analyzer have to be low enough "such that the second rod set will operate as a mass filter."

These pressure limitations must further incorporate a restriction that AB/Sciex imposed during reexamination, namely that the pressure in the second chamber be at least below 1×10^{-5} torr. In the 1997 Request for Reexamination, AB/Sciex imposed this restriction as part of its effort to distinguish prior art. In discussing the prior-art "Stafford application," AB/Sciex observed:

> The Stafford application states that the sensitivity and mass resolution are significantly improved when a collision quenching gas is introduced into the ion trap at a total pressure of 1×10^{-1} to 1×10^{-5} torr.

(JA 178, Request for Reexamination.) On the next page of the Request, AB/Sciex distinguished the Stafford application on the ground that it "does not disclose or suggest that the second vacuum chamber be operated at a very low pressure." (JA 179, Request

for Reexamination.) AB/Sciex thus made clear its belief that 1 x 10^{-5} torr does not qualify as the kind of "very low pressure" necessary to operate the "second rod set" as a "mass filter." *See Cultor*, 224 F.3d at 1331. ("Claims are not correctly construed to cover what was expressly disclaimed."). The Court should incorporate this disclaimer of claim scope into its constructions of the "very low pressure" and "substantially lower pressure" limitations of claims 1 and 14.

M. "The Length of Said First Rod Set"

'736 Term	Claims	Thermo Proposal	AB/Sciex Proposal
the length of said first rod set	1, 14	the length of the rods in the direction of the longitudinal axis.	No construction necessary.

A "rod" is a three-dimensional object that has "lengths" in different directions. Because of the resulting potential ambiguity regarding the meaning of the term "length," Thermo seeks a construction that will clarify the relevant length for purposes of the claims.

The specification and prosecution history make clear that the relevant length is the length along the longitudinal axis that corresponds to the ion path. Claims 1 and 14 describe "the length of the first rod set" as a factor for determining a pressure-times-length parameter for the "first chamber." (JA 22, 23, '736 patent, 14:65-67, 16:14-16.) The written description explains that this pressure-times-length parameter corresponds to "the number of collisions which an ion has while travelling through the AC-only rods 32." (*See* JA 22, '736 patent, 13:3-6, 13:27-31.) AB/Sciex's 1997 Request for Reexamination confirms that "the length of the first rod set" that is of interest is the "path length" for the ions running through the mass spectrometer—i.e., the length along the system's longitudinal axis. (JA 196-99, JA 206, JA 208-10.)

N. "Improved Transmission of Ions Through Said Interchamber Orifice"

'736 Term	Claims	Thermo Proposal	AB/Sciex Proposal
improved transmission of [said] ions through said interchamber orifice	1, 14	Transmission of [said] ions that is better than that which would occur at a pressure-times-length value for the first chamber and first rod set below 2.25×10^{-2} torr cm.	increased transmission of ions through the interchamber orifice over that which would occur absent either a product of pressure in the first chamber times length of the first rod set being equal to or greater than 2.25×10^{-2} torr cm, or the kinetic energies of ions entering the first rod set being maintained at a relatively low value.

The ending language of claims 1 and 14 requires "improved transmission of ions through said interchamber orifice" and "improved transmission of said ions through said interchamber orifice," respectively.[12] Consistent with the plain meaning of "improved," Thermo proposes that this language be construed to require transmission of "ions" or "said ions" which is ***better*** than that which would occur at a pressure times-length value below 2.25×10^{-2} torr cm. (*See* TA 157, *Webster's Ninth New Collegiate Dictionary* (1988) (defining "improve" as meaning "to enhance in value or quality: make better"); TA 131, *American Heritage Dictionary* (2d coll. ed. 1985) (defining "improve" as meaning "[t]o raise to a more desirable or more excellent quality or condition; make better").)

AB/Sciex commits two errors. First, it proposes that "improved" be construed as meaning "increased." Particularly as used in this context, however, "increased" is not a synonym for the claim term "improved." As noted above, the ordinary meaning of "improved" means to make qualitatively better, not merely to make more voluminous.

[12] During the Micromass litigation, AB/Sciex conceded that the "whereby clause" at the end of claim 1 "is a claim limitation." *Micromass*, 186 F. Supp. 2d at 526 (JA 524).

Further, as discussed in detail below, the patent's specification and prosecution history repeatedly emphasize that the (alleged) invention concerns having qualitatively better transmission of ions.

Second, the parties agree that improved transmission must result from increased pressure (i.e., the PxL value). However, AB/Sciex errs by contending that improved transmission also must result from the tuning of the voltages on the various elements, i.e., setting the "kinetic energies." Contrary to AB/Sciex's argument, the specification and file history tie improved performance to pressure, but not to voltage.

Figures 3 through 8 of the '736 patent, and the associated text describing them, are intended to show "improved transmission" by showing substantial increases in transmission as the pressure is raised. (*See* JA 3-6, '736 patent, figs. 3-8; *see also* JA 17, 18, '736 patent, 3:24-43, 6:11-61.) An alternative experiment is described as "showing that a greater relative enhancement [of transmission] occurred with increased pressure when the smaller orifice **36** was used." (JA 19, '736 patent, 7:58-60.) Table I of the patent similarly reports significantly enhanced transmission based on a comparison of "ion signal[s]" at a pressure of 5 millitorr with those at a pressure of 0.5 millitorr. (*See* JA 20, '736 patent, 9:42-62.) Further, the specification speaks of the "markedly increased" transmission, or "a considerable increase in the transmitted ion signal," that results when "the gas pressure in the region of the ion optic elements is increased within certain limits and when the other operating conditions are appropriately established." (*See* JA 16, 18, '736 patent, 1:45-50, 5:40-46.) The discussion accompanying Table II does describe effects that voltage can have on transmission, but uses this information to correct potential overstatement of the effect of "improved transmission" based on

pressure, not to change the general test for "improved transmission" itself. (JA 20, '736 patent, 10:3-15.)

Similarly, in its Request for Reexamination, AB/Sciex stated that "[t]he mass spectrometer according to the invention uses an increased pressure to improve ion transmission." (JA 180.) The invention's approach was contrasted to "the conventional wisdom that the increased pressure would reduce ion current." (JA 181; *cf.* JA 394, ¶ 8.) In a later Amendment, AB/Sciex similarly contrasted its invention to prior-art teachings and alleged that the inventors had "unexpectedly discovered that ion transmission can be improved by actually ***increasing*** the gas pressure within the first chamber." (JA 424, emphasis original.)

In sum, all of these statements tie improved transmission to increased pressure. It is true that the specification and prosecution history speak of tuning voltages in addition to tuning pressures. However, the test for "improved transmission" is presented as one of varying pressures while holding ion kinetic energies "relatively low," requirements regarding such "relatively low" energies being separately imposed by both claim 1 and claim 14. Hence, the claims' "improved transmission" language requires ion transmission better than that which would occur at a pressure-times-length value below 2.25×10^{-2} torr cm.

V. Disputed Claim Terms for the '784 Patent

A. "Mass Analyzer"

'784 Term	Claims	Thermo Proposal	AB/Sciex Proposal
mass analyzer	1, 4	Any device usable either to deliver ions to another structure selectively, or to detect ions selectively, based on ion mass-to-charge ratios.	A device that sorts ions according to their mass to charge ratio and detects them.

Thermo's construction of "mass analyzer" is consistent with the plain meanings of "mass analyzer," "quadrupole mass analyser," "mass analysis," and the related terms "analyzer," "analysis," and "analyze." (*See, e.g.*, TA 186, 187, *Compendium of Analytical Nomenclature* (3d ed. 1998) (defining "quadrupole mass analyser" as "[a]n arrangement in which ions with a prescribed mass/charge ratio are made to describe a stable path under the influence of a static and a high frequency electric field and are then detected," and defining "mass analysis" as "[t]he process by which a mixture of ionic or neutral species is identified according to their mass/charge ratios (ions) or their aggregate atomic masses (neutrals)"); TA 146, *McGraw-Hill Dictionary of Scientific and Technical Terms* (4th ed. 1989) (defining "analysis" as "[t]he determination of the composition of a substance"); TA 173, *Webster's Third New International Dictionary* (1986) (defining "analyze" as meaning "to ascertain the components of or separate into component parts").)

Thermo's construction is also consistent with use of the term "mass analyzer" in the '784 patent's specification, where the term "mass analyzer" is used to describe, for example, a combination of elements consisting of three quadrupoles plus a detector, as well as "other types of mass analyzers such as quadrupole ion trap, ion cyclotron resonance (i.e., magnetic ion trap), time-of-flight, magnetic sector, and double-focusing

magnetic/electric sector, monopole, etc." (*See* JA 593, 602, 604, '784 patent, 4:32-33, 7:5-10, fig. 1.)

In contrast, AB/Sciex's proposed construction is vague in that it describes an analyzer as "sort[ing] ions," but does not clarify what "sorting" means in this context. Additionally, AB/Sciex's proposed construction is overly restrictive in that it requires that an analyzer always perform detection. In fact, the term "mass analyzer" sometimes refers to a device that does detection, but other times refers to a device that does no more than deliver ions selectively to another structure. (*See, e.g.*, TA 203, 204, *Analytical Chemistry Handbook* (1995) ("The function of the mass analyzer is to separate the ions produced in the ion source according to their different mass-to-charge ratios.... After leaving a mass analyzer, the resolved ion beams sequentially strike some type of detector."); TA 190, *A Glossary for Mass Spectrometry* (June 2002) ("The analyzer is the section of the mass spectrometer in which ions (formed in the source) are differentiated on the basis of their mass-to-charge ratios. The detector of the instrument follows the mass analyzer(s).").)

B. "Adduct Ions"

'784 Term	Claims	Thermo Proposal	AB/Sciex Proposal
adduct ion(s)	1, 4	An ion formed by combining two or more different kinds of particles, usually an ion and a molecule.	Ions formed by a non-covalent association between sample ions and solvent molecules.

The *Compendium of Analytical Nomenclature: Definitive Rules 1997* (1998) defines an "adduct ion" as "[a]n ion formed by interaction of two species, usually an ion and a molecule, and often within an ion source, to form an ion containing all the constituent atoms of one species as well as an additional atom or atoms." (TA 188.) Thermo's construction is consistent with this plain meaning.

AB/Sciex's alternative proposed construction of "adduct ions" is overly narrow, restricting the general term "adduct ion" to a particular kind of adduct ion described in the specification. AB/Sciex's proposed construction also makes other claim language superfluous. AB/Sciex proposes that the term "adduct ions" be restricted to "ions formed by a non-covalent association between sample ions and solvent molecules." Although these are examples of adduct ions, "adduct ion" is a more general term. By itself, "adduct ion" does not require a "non-covalent association" or restriction to combinations of "sample" and "solvent." (TA 188, *Compendium of Analytical Nomenclature* (1998) (defining "adduct ion").) This is demonstrated by the language of claims 1 and 4 themselves, which provide separate language to establish that the "adduct ions" of interest are formed from "sample ions and solvent molecules." (*See* JA 604, '784 patent, 7:16, 8:2-4.) The addition of this extra language in the claims confirms the patentees' intent that the term "adduct ion" by itself carry the broader and ordinary meaning of that term.

C. "Multipole Ion Guide" and "Ion Lens"

'784 Term	Claims	Thermo Proposal	AB/Sciex Proposal
multipole ion guide	1, 4	A device that confines ions radially and guides them along an extended longitudinal path, as determined by multipolar electric and/or magnetic fields.	A rod set to which an AC voltage is applied that confines ions radially along a longitudinal path.
ion lens	4	A device to which one or more voltages are applied so that the device deflects ions and may be used to focus or otherwise to change the shape or direction of an ion beam without continuously confining the ions radially along an extended longitudinal path.	An electrostatic device for changing the path of an ion beam.

The terms "multipole ion guide" and "ion lens" denote distinct kinds of structures that are used to affect the path that ions follow in traveling through a mass spectrometer. In general, an "ion guide" is a kind of "pipe" used to transport ions from one place to

another along some extended path. The term "multipole" and its adjectival variant "multipolar" describe systems having two positive charges and two negative charges. (TA 166, 2 *Webster's Third New International Dictionary* (1993) (defining "multipole" as a system "involving two or more pairs of electric or magnetic dipoles . . ."). An "ion lens," on the other hand, acts in a way more analogous to an optical lens: it deflects or focuses ions without holding them for extended transport. Thermo's proposed constructions are meant to clarify these distinctions between a "multipole ion guide" and an "ion lens," and to do so consistently with the ordinary meaning of the terms as well as the '784 patent's specification.

The ordinary meaning of the terms shows the proper distinction between "guide" and "lens." The key difference is that in a guide, the ions are confined radially (i.e., confined in their up/down and side-to-side movements) and guided along an extended pathway, whereas in a lens the ions are "directed" or "focused" without being continuously confined radially along such a pathway. (*Cf.* TA 166, *Webster's Third New International Dictionary* (1993) TA 170, *Webster's Third New International Dictionary* (1993) (defining "wave guide" as "a metal pipe of circular or rectangular cross section or a dielectric cylinder of such dimensions that it will propagate electromagnetic waves of a given frequency . . ."); TA 143, *McGraw-Hill Dictionary of Scientific and Technical Terms* (5th ed. 1994) (defining "waveguide" as "a metallic tube which can confine and guide the propagation of electromagnetic waves in the lengthwise direction of the tube"); TA 132, *American Heritage Dictionary* (2d coll. ed. 1985) (defining a "lens" as a "device that causes radiation other than light to converge or diverge by action analogous to that of

an optical lens"); TA 150, *Merriam Webster's Collegiate Dictionary* (10th ed. 1993) ("lens" is "a device for directing or focusing radiation other than light").)

The '784 specification is consistent with this plain meaning of both ion guide and lens. In Figure 1, it depicts ion guide elements 27 and 28 that "guide[]" ions through the intermediate chambers "into the mass analyzer." (*See* JA 602, '784 patent, 4:64-66.) In one embodiment, rods are described as being 1.25 inches and 3.37 inches long respectively, and as being separated by 0.118 inches, thereby defining the type of extended longitudinal pathway contemplated by the ordinary meaning of "ion guide." (*See* JA 602-03, '784 patent, 4:64 to 5:10.)

Figure 1 of the '784 specification depicts lens elements 24, 18, 36 as plate-like elements which are too short to confine ions or to create a pathway for their travel. (*See* JA 593, 603, '784 patent, 5:6-10, fig. 1.) The specification states that the purpose of the lenses is to "direct[]" ions into the next element. (*See* JA 602, '784 patent, 3:17-19, 22-24.)

AB/Sciex's constructions of "multipole ion guide" and "ion lens" are inappropriate for two reasons. First, the definitions will not help the jury understand the difference between a "guide" and a "lens," which is important when construing these two terms. Second, AB/Sciex improperly attempts to import limitations from the specification into these terms. *See Phillips*, 415 F.3d at 1320 (importing a limitation from the specification into a claim is "one of the cardinal sins of patent law") (internal quotation marks omitted).

AB/Sciex attempts to import limitations into the claims by construing "multipole ion guide" as restricted to a "rod set to which an AC voltage is applied." Nothing in the

plain meaning of "multipole ion guide" requires that it have a "rod set" or an AC voltage, and nothing in the specification limits or re-defines "ion guide" in this way. The requirements of a "rod set" and "an AC voltage" have no basis in the term "multipole ion guide," as confirmed by the dictionary definitions cited above. A "multipole" is not tied to any particular structure, such as a "rod set." A "multipole" also can involve "static or oscillating distributions of charge or magnetization" generally, so is not tied to "an AC voltage." (TA 142, *McGraw-Hill Dictionary of Scientific and Technical Terms* (5th ed. 1994) (defining "multipole" to include structure with "static or oscillating" charge).) The fact that the specification describes "one example" of the invention as having rods to which an AC voltage is applied (*e.g.*, JA 602-03, '784 patent, 4:64 to 5:5) cannot be a basis for limiting the broad term "multipole ion guide" to that particular embodiment. *See Interactive Gift Express, Inc. v. Compuserve, Inc.*, 256 F.3d 1323, 1341 (Fed. Cir. 2001) (it is improper to read characteristics of the preferred embodiment into a claim as a limitation).

AB/Sciex similarly errs when it attempts to restrict an "ion lens" to an "electrostatic device" and to a device that "chang[es] the path of an ion beam." As noted in the definitions cited above, under its plain meaning, a lens can be used simply as a device for focusing a beam, rather than as a device for "changing" a beam's overall "path." The specification refers to the lens "directing" the ions (JA 602, '784 patent, 3:17-26), not "changing" the "path" of a "beam." Similarly, it is well established that an "ion lens" need not be an "electrostatic device." As confirmed by the specification, an "electrostatic lens[]" is merely one type of lens. (*See* JA 601, '784 patent, 1:42-44.) If all lenses were "electrostatic," the '784 patent's reference to "electrostatic lenses" would

be wholly superfluous. AB/Sciex knows well that an "ion lens" need not be electrostatic. AB/Sciex has its own patent, U.S. Patent No. 6,504,148 ("the '148 patent"), assigned to MDS Inc., that describes the use of short "***RF-only***" "stubbies" "which serve as a Brubaker ***lens***." (*See* TA 216, '148 patent, 5:26-30.)

D. "Means . . . for Increasing the Translational Kinetic Energy of the Adduct Ions ..."

'784 Term	Claims	Thermo Proposal	AB/Sciex Proposal
means associated with one or both of said first and second multipole ion guides for increasing the translational kinetic energy of the adduct ions	1	1. The corresponding structures described in the specification include a skimmer **24** that precedes the first ion guide **27**, a lens **18** located between the first and second ion guides **27** and **28**, and their associated voltage sources. 2. "Associated with one or both of said first and second multipole ion guides" means that the "means ... for increasing" has a relation to either or both of the first and second multipole ion guides.	1. The corresponding structure, material, or acts described in the specification is a DC offset voltage between the first multipole ion guide and the immediately preceding lens (ion guide 27 and skimmer 24), or a DC offset voltage between the second ion multipole ion guide and its immediately preceding lens (ion guide 28 and lens 18), or both. 2. No construction required separate from that set forth in 1[] above.

Thermo and AB/Sciex agree that claim 1's "means ... for increasing" limitation is a means-plus-function limitation subject to § 112, ¶ 6. They also agree that the associated function is "increasing the translational kinetic energy of the adduct ions so that at the vacuum pressure of the second interface chamber adduct ions traveling into the chamber are converted into sample ions without fragmentation of sample ions." They disagree, however, regarding the nature of the "corresponding structures."

Thermo contends that the corresponding structures include a skimmer (**24**) that precedes the first ion guide, a lens (**18**) located between the first and second ion guides, and their associated voltage sources. (*See* JA 593, 600, 602, 603, '784 patent, 3:26-38, 3:50-56, 5:5-10, 5:20-31, 6:19-45, 6:49-57, figs. 1 & 8.) These are the structures that are clearly linked to the function, and the specification teaches that the DC voltage differentials can be arranged among these elements in various combinations: "[t]he method comprises applying a DC voltage between the ion lens preceding **either** the first

or the second multipole ion guide to provide translational kinetic energy to the adduct ions." (*See* JA 602, '784 patent, 3:50-54 (emphases added).)

AB/Sciex asserts that one of two possible "DC offset voltage[s]" constitutes the required "corresponding structure, material, or acts." As discussed in the context of the '736 patent, AB/Sciex's attempt to treat an operating parameter or a characteristic of energy—such as "voltage"—as a "corresponding" structural limitation must fail. A structural means-plus-function limitation must be construed in accordance with "corresponding structure" in the specification. *See O.I. Corp.*, 115 F.3d at 1582-83; *Default Proof*, 412 F.3d 1298. A "voltage" is not such structure.

AB/Sciex also seeks to inject the limitation "immediately preceding" into the construction. This is another improper attempt to import particular embodiments into the claims as a limitation. The word "immediately" is not stated or even suggested in the claim language. Further, the specification describes a broader application than the one proposed by AB/Sciex. As noted, the specification states that "[t]he method comprises applying a DC voltage between the ion lens preceding **either** the first **or** the second multipole ion guide to provide translational kinetic energy to the adduct ions." (JA 602, '784 patent, 3:50-54 (emphases added).) Notably absent from the quoted passage is the term "immediately."[13] The lens must precede the ion guide, but it need not "immediately" precede the ion guide; for example, the DC voltage difference ("offset") could be between the first lens (element 24) and the second ion guide (element 28). Thus, the specification teaches that the restriction proffered by AB/Sciex ("immediately

[13] The inventors knew how to use the term "immediately" when they wished to do so. For example, the specification notes at least one embodiment in which the first and second ion guide chambers "immediately preced[e]" the mass analyzer. (*See* JA 602, '784 patent, 3:48-50.)

preceding") is unnecessary to practice the patent. There is no basis to import the limitation "immediately" (which applies to only some embodiments) into the broader claims.

E. "Whereby to Increase the Sample Ion Current ..." and "to Increase the Sample Ion Current ..."

'784 Term	Claims	Thermo Proposal	AB/Sciex Proposal
1. whereby to increase the sample ion current and therefore the sensitivity of the mass spectrometer system [claim 1]	1, 4	1. The sensitivity of the mass spectrometer system is increased because the flow of sample ions is increased relative to the flow of sample ions in the absence of dissociation of adduct ions at the pressure of the second chamber.	1. The sensitivity of the mass spectrometer system is increased due to an increase in sample ion current entering the mass analyzer that is caused by the conversion of adduct ions into sample ions in the second chamber without fragmentation of sample ions.
2. to increase the sample ion current and therefore the sensitivity of the mass spectrometer system [claim 4]		2. same as #1 above.	2. The sensitivity of the mass spectrometer system is increased due to an increase in sample ion current entering the mass analyzer that is caused by the dissociation of adduct ions in the second chamber without dissociating sample ions.

AB/Sciex's proposed constructions differ from Thermo's in two main respects. First, AB/Sciex's constructions distinguish between claim 1's discussion of "conversion of adduct ions" and claim 4's discussion of "dissociation." The specification clarifies that "conversion" and "dissociation" are meant to indicate the same process. In particular, the discussion in the specification section entitled "OBJECTS AND SUMMARY OF THE INVENTION" makes clear that, in this context, "convert[ing] adduct ions into sample ions" and "dissociat[ing]" "adduct ions" refer to the same process. (*See* JA 601-02, '784 patent, 2:64 to 3:57.) Consequently, AB/Sciex's distinction between "conversion" and "dissociation" seems unsupported and/or unnecessary.

Second, AB/Sciex imports the additional limitation "caused by" into the construction. The claims do not say "caused by," nor is this the plain meaning of "whereby." Notably, in construing the "improved transmission" portion of the "whereby" clause that appears in its own '736 patent, AB/Sciex did not propose adding this phrase "caused by." There is no reason to add the "caused by" language to Thermo's patent while omitting it from AB/Sciex's patent. Thermo would agree to add "caused by" to these claims, so long as a "caused by" requirement is also added to the improved ion transmission limitation of AB/Sciex's '736 patent.

F. "Applying a DC Offset Voltage Between a Selected One or Both Lenses and the Succeeding Multipole Ion Guide"

'784 Term	Claims	Thermo Proposal	AB/Sciex Proposal
applying a DC offset voltage between a selected one or both lenses and the succeeding multipole ion guide	4	Supplying DC voltage such that there is a voltage difference between at least one of the lenses and the ion guide that comes after them.	Applying a DC offset voltage to at least one of the lenses and the ion guide that comes immediately after it.

Thermo's construction is consistent with the plain meaning of "succeeding." (*See* TA 169, *Webster's Third New International Dictionary* (1993) (defining "succeed" as meaning "to follow or take place after another"); TA 126, *American Heritage College Dictionary* (3d ed. 1993) (defining "succeed" as meaning "[t]o follow in time or order").)

AB/Sciex again seeks to import the limitation "immediately" into the claim language. This is incorrect; one thing may follow or "succeed" another without "immediately succeeding" it, which the claims do not require. Indeed, the claim language of claim 4 is directly contrary to AB/Sciex's construction. Claim 4 speaks of a "voltage between a selected one or both lenses and the succeeding multipole ion guide." This language indicates that the "multipole ion guide" in question may "succeed" both lenses—not just one lens. This "succeeding" ion guide is thus associated with voltages

on "one or both" of the preceding lenses, not merely the lens that "immediately" precedes the ion guide. As noted above, the specification teaches that voltages associated with either of such lenses will produce dissociation "at the pressure of the second chamber." (*See* JA 602, '784 patent, 3:50-57.)

G. "A DC Offset Voltage ... Having an Amplitude so as to Provide Translational Kinetic Energy to Said Adduct Ions ..."

'784 Term	Claims	Thermo Proposal	AB/Sciex Proposal
a DC offset voltage ... having an amplitude so as to provide translational kinetic energy to said adduct ions to dissociate the adduct ions without dissociating the sample ions at the pressure of the second chamber	4	**One or more** DC offset voltages provides translational kinetic energy such that, at the vacuum pressure of the second chamber, adduct ions that have entered the second chamber are broken up to form additional sample ions without fragmentation of sample ions.	**The** DC offset voltage provides sufficient translational kinetic energy to the adduct ions entering the second chamber to dissociate them without dissociating sample ions at the pressure of the second chamber, which is less than 1 mTorr.

Thermo's proposed construction of the "DC offset voltage" limitation recognizes that one or more DC voltages—in particular, DC voltages "between a selected one or both lenses and the succeeding multipole ion guide"—could be at issue here. AB/Sciex's construction suggests that there is only one DC voltage at issue. The claim language makes clear that this part of the claims is directed to "a DC offset voltage between a selected *one or both* lenses and the succeeding multipole ion guide" (emphasis added), and so one or more DC offset voltage may be used.

CONCLUSION

For the foregoing reasons, Thermo respectfully requests that the Court construe the disputed claim terms of the '736 and '784 patents in accordance with Thermo's proposed constructions. Thermo respectfully submits that its constructions properly and consistently follow the rules of claim construction, while AB/Sciex tries to manipulate these rules to achieve the particular result that it wants in this case.

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Dated: November 18, 2005

CERTIFICATE OF SERVICE

I hereby certify that on November 18, 2005, I electronically filed the foregoing document with the Clerk of Court using CM/ECF which will send notification of such filing, and hand delivered, to the following:

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